Issued June 1971

SOIL SURVEY
WASHINGTON COUNTY
Wisconsin

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
UNIVERSITY OF WISCONSIN
Wisconsin Geological and Natural History Survey
Soils Department
and
Wisconsin Agricultural Experiment Station

Major fieldwork for this soil survey was done in the period 1963–65. Soil names and descriptions were approved in 1966. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1965. This survey was made cooperatively by the Soil Conservation Service and the Wisconsin Geological and Natural History Survey, Soils Department, and the Wisconsin Agricultural Experiment Station, University of Wisconsin, as part of the assistance furnished to the Washington County Soil and Water Conservation District.

The fieldwork that is the basis for this soil survey was partly financed by Washington County; by the Southeastern Wisconsin Regional Planning Commission; and by a joint planning grant from the State Highway Commission of Wisconsin; the U.S. Department of Commerce, Bureau of Public Roads; and the Department of Housing and Urban Development; under provisions of the Federal Aid Highway Legislation and Section 701 of the Housing Act of 1954, amended.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or can be purchased on individual order from the Cartographic Division, Soil Conservation Service, USDA, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Washington County are shown on the detailed soil map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol. It shows the page where each kind of soil is described, and also the page for the capability unit, woodland group, recreation group, and wildlife group.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units, recreation groups, woodland groups, and wildlife groups.

Foresters and others can refer to the section "Use of the Soils as Woodland," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife Management."

Community planners and others concerned with suburban development can read about soil properties that affect the choice of homesites, industrial sites, schools, and parks in the subsections "Engineering Uses of the Soils" and "Recreational Uses of the Soils."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation, Morphology, and Classification of Soils."

Newcomers in Washington County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "General Nature of the County," which gives additional information about the county.

Cover: Contour stripcropping helps to control erosion on Fox, Casco, and Matherton soils in capability classes II and III.

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SOIL SURVEY OF WASHINGTON COUNTY, WISCONSIN

BY KEITH O. SCHMUDE, SOIL CONSERVATION SERVICE

SOILS SURVEYED BY ORVILLE R. HASZEL, DONALD C. KURER, DALE E. PARKER, ROBERT PATZER, STEVE PAYNE, ROGER WEBER, AND KEITH O. SCHMUDE, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE UNIVERSITY OF WISCONSIN, WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY, SOILS DEPARTMENT, AND THE WISCONSIN AGRICULTURAL EXPERIMENT STATION

WASHINGTON COUNTY is in the southeastern part of Wisconsin (fig. 1). Its land area is 428 square miles, or 273,920 acres. West Bend, the county seat, is in the north-central part of the county.

The soils in Washington County range from loamy to sandy, from shallow to deep, and from very poorly drained to excessively drained. Glaciation is chiefly responsible for the many kinds of soil that formed. It affected the formation of the soils by depositing several kinds of parent material and by sculpturing a wide variety of landforms (fig. 2). In most areas of the county a silt mantle of loess was deposited by wind. This mantle generally is thick in the western part of the county, but it is very thin or absent in the eastern part.

Much of the county is underlain by dolomite bedrock, though some dolomitic shale underlies the southwestern and northern parts. In most places glacial drift is many feet thick over the bedrock. The dolomite bedrock is at the surface or within 20 feet of it in several small areas in the northwestern part of the county and in several larger areas in the southeastern part. Some dolomite crops out in the southern half of the county.

In many places the loamy soils in the county are used for corn, small grains, legumes, and other farm crops. Peas, sweet corn, red beets, and similar crops are grown for canning. Soils that are steep and very shallow are used mainly for pasture, as woodland, or for recreation or wildlife areas. Dairying is the principal source of income for farmers. Community development in the county is adding to the industrial, residential, and recreational uses of the soils.

Figure 1.—Location of Washington County in Wisconsin.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soils are in Washington County, where they are located, and how they can be used. The soil scientists went into the survey area knowing they likely would find many soils they had already seen, and perhaps some they had not. As they traveled over the county, they observed steepness, length, and shape of slopes; size and speed of

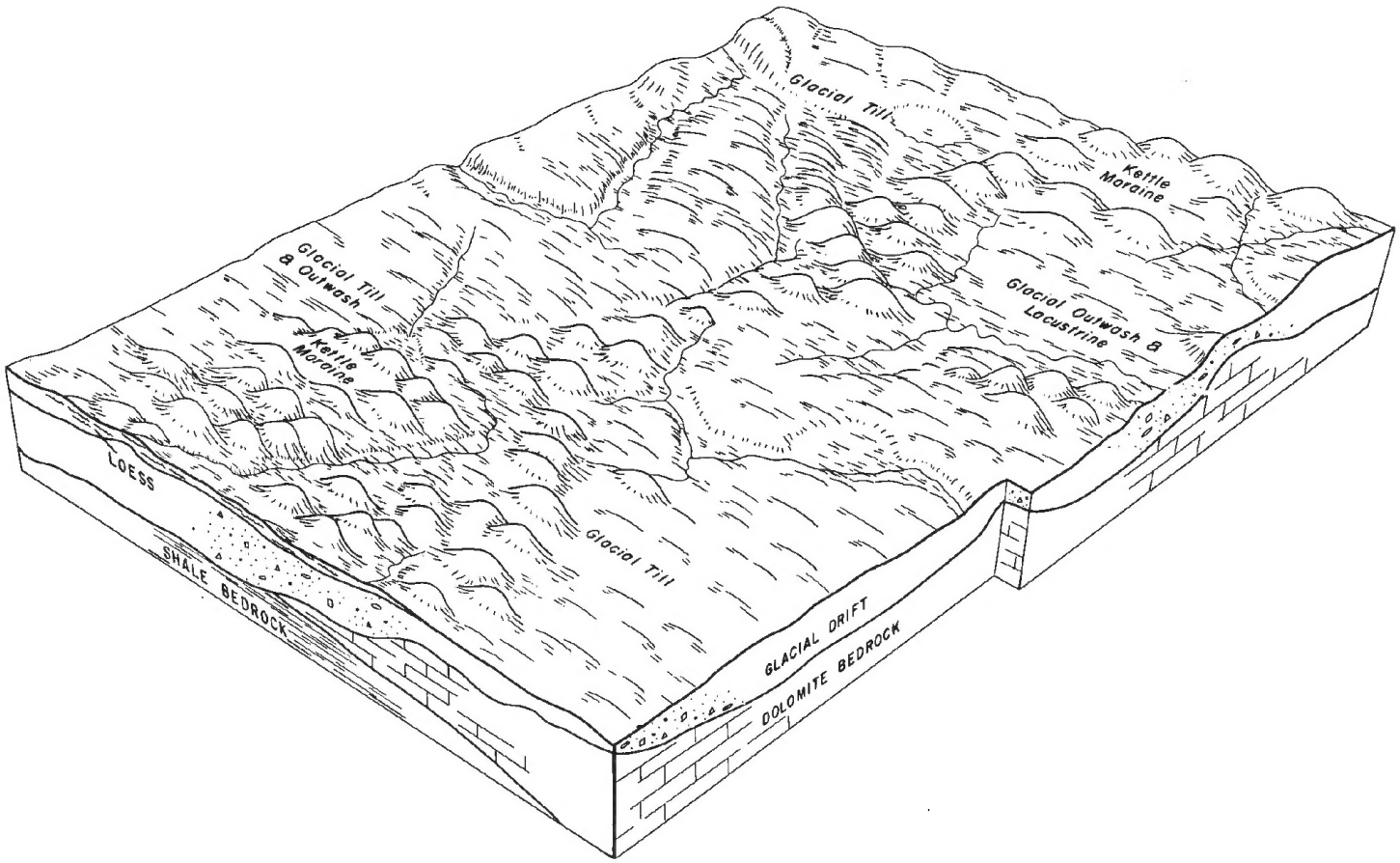

Figure 2.—**Physiography and drainage in Washington County.**

streams; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The soil series and the soil phase are the categories most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Theresa and Hochheim, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ somewhat in texture of the surface soil and in slope, stoniness or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Hochheim loam, 6 to 12 percent slopes, eroded, is one of several phases within the Hochheim series.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. One such kind of mapping unit in Washington County is a soil complex.

A soil complex consists of two or more soils so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of two or more dominant soils, and the pattern of and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Casco-Rodman complex, 6 to 12 percent slopes, eroded, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the sur-

vey, but they are called land types instead of soils and are given descriptive names. Alluvial land and Marsh are examples of two land types in Washington County.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are estimated for all the soils.

The soil scientists set up trial groups on the basis of yield and practice tables and other data. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. Then they adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Washington County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is also useful in determining the suitability of tracts for a watershed, for growing wood products, for wildlife habitat, for engineering work, for recreational areas, and for community developments. Such a map, however, is not suitable for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The seven soil associations in Washington County are discussed in the following pages.

1. Casco-Fox-Rodman Association

Well-drained to excessively drained soils that have a subsoil of gravelly sandy loam to clay loam; very shallow to moderately deep over gravel and sand, on outwash terraces

This association consists of gently sloping to very steep soils that are underlain by stratified, calcareous gravel and sand (fig. 3, *top*). Several areas are along the Kettle Moraine, which extends from the northern boundary of the county to the southwestern corner (see fig. 2).

The soils of this association are on outwash terraces that were formed by melt water from glaciers that converged on both sides of the Kettle Moraine. The landscape is one of rolling to hilly ridges. The pattern of drainage away from the moraine is irregular.

This association occupies about 15 percent of the county. The Casco soils make up 40 percent of it; the Fox, 25 percent; the Rodman, 15 percent; and minor soils, the remaining 20 percent.

The Casco soils are generally sloping or moderately steep. They have a loamy or sandy loam surface layer and are less than 20 inches deep over gravelly outwash. They are on ridgetops and side slopes above the Fox soils. Rodman soils are very shallow gravelly soils that occur mostly on ridgetops and steep slopes in rolling and hilly areas (fig. 4). The Fox soils are nearly level to sloping and are in broad areas. These soils are generally below areas of the Casco and Rodman soils. They formed mainly in a silty mantle that is as much as 24 inches thick over gravelly outwash. Generally they are silt loam or silty clay loam, but in some places they have a loam or sandy loam surface layer.

Minor soils in this association, such as the Matherton, Fabius, Mussey, and Sebewa, are nearly level or depressional and occur between sloping to steep hills or ridges.

The nearly level to sloping Casco and Fox soils are in corn, small grains, legumes, and other cultivated crops. The steeper Rodman and Casco soils are used for trees and for recreational purposes. Bridle paths, hiking trails, and scenic drives are being developed on many of the steeper soils that are not well suited to cultivation.

The major soils of this association have severe limitations as sites for reservoirs because the gravelly substratum is pervious and difficult to seal. These soils, however, are a good source of sand and gravel. They are stable and have high bearing capacity. Limitations to construction of foundations for low buildings are few. Limitations for onsite disposal of sewage are slight on the well-drained Casco, Fox, and Rodman soils.

2. Hochheim-Theresa Association

Well-drained soils that have a subsoil of clay loam; formed in loess and the underlying sandy loam to loam glacial till, on uplands

This association consists of nearly level to steep soils that are underlain by calcareous loamy glacial till (see fig. 3, *bottom*). The soils are mainly gently sloping to steep and occur on till moraines that were formed by the movement of glacial ice (fig. 5). The drainage pattern of the soils in this association is irregular.

This association occurs in all parts of the county and occupies about 50 percent of its area. Hochheim soils make up 30 percent of the association; Theresa soils, 25 percent; and the minor soils, the remaining 45 percent.

The Hochheim soils have a loam and silt loam surface layer and are less than 24 inches deep over sandy loam to loam glacial till. These soils are generally sloping or moderately steep and occur mainly on ridgetops and side slopes above the Theresa soils. The steeper Hochheim soils occur with the well-drained Hennepin soils, which are less than 12 inches thick over sandy loam to loam till. The Theresa soils are nearly level to sloping and occur in broad areas, generally below the Hochheim soils. They have as much as 30 inches of silt loam and silty clay loam over sandy loam to loam glacial till.

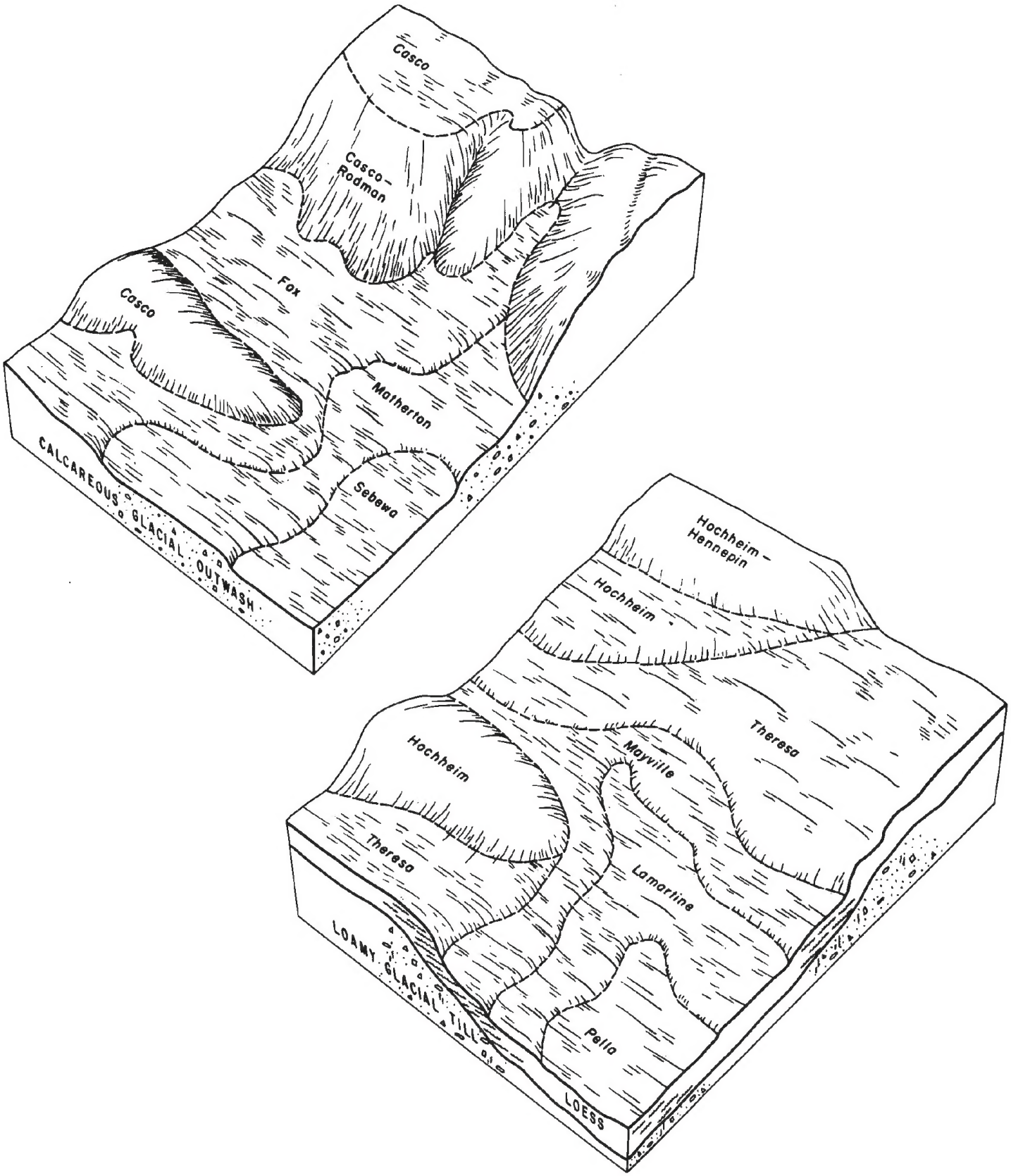

Figure 3.—Relationship of soils to landscapes. *Top,* soil association 1; *bottom,* soil association 2.

Figure 4.—**Steep soils in soil association 1 that are along an esker ridge in the Kettle Moraine. The soils are Casco and Rodman.**

Minor soils in the association are the Mayville, Lamartine, Brookston, and Pella. These soils occur along foot slopes or between sloping to steep soils on hills or ridges.

The nearly level to sloping Hochheim and Theresa soils are in corn, small grains, legumes, and other cultivated crops. The steeper Hochheim and Hennepin soils are used for trees and recreational purposes. Bridle paths, hiking trails, and scenic drives are being developed in many areas of steeper soils that are less suitable for cultivation.

The major soils of this association have slight to moderate limitations as sites for construction of reservoirs because the underlying glacial till is semipervious. This material is stable, however, and is only slightly limited for use in constructing foundations for low buildings. Limitations for onsite sewage disposal are slight on the well-drained Hochheim and Theresa soils.

3. Ozaukee-Martinton-Saylesville Association

Well-drained and somewhat poorly drained soils that have a subsoil of silty clay loam to clay; over silty clay loam glacial till or lake-laid silt and clay, on ground moraines and lacustrine basins

This association consists of nearly level to steep soils that are underlain by calcareous silty clay loam glacial till and lacustrine silt and clay (fig. 6, *top*). These soils are mostly in the eastern half of Washington County. The landscape consists of soils that form broad, smooth hills and valleys. The drainage pattern in the association is irregular.

The soils in the association occupy about 9 percent of the county. Ozaukee soils make up about 50 percent of the association; Martinton soils, 10 percent; Saylesville soils, 8 percent; and the minor soils, the remaining 32 percent. Areas of this association adjacent to Waukesha and Ozaukee Counties have a larger percentage of the minor Mequon soils and a smaller percentage of Martinton and Saylesville soils.

The Ozaukee, Saylesville, and Martinton soils have a silt loam surface layer. Ozaukee soils are well drained and less than 40 inches deep over silty clay loam glacial till. They generally are gently sloping and are on broad uplands adjacent to and above the Martinton soils. Saylesville soils are well drained and less than 40 inches deep over lacustrine silt and clay. Generally they are gently sloping and are on uplands above the Martinton soils. Martinton soils are in depressional areas, are somewhat poorly drained, and are less than 40 inches deep over lacustrine silt and clay. They have a water table within 3 feet of the surface during wet periods. They occur along foot slopes below the Ozaukee and Saylesville soils.

Minor soils in this association are the Mequon, Aztalan, and Montgomery. These nearly level and gently sloping

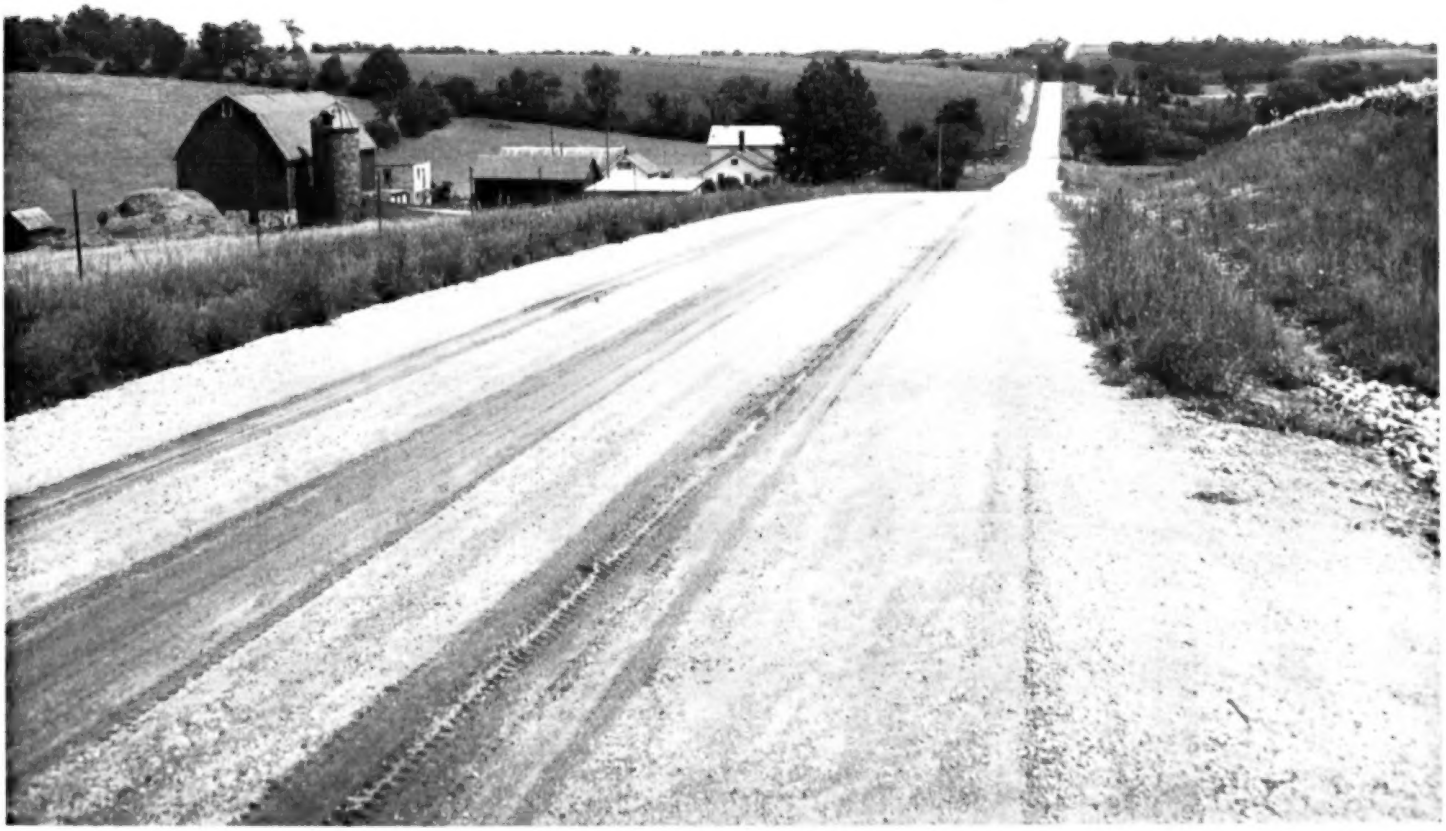

Figure 5.—**Drumlins and ground moraines on the soils in the Hochheim-Theresa association in the northern part of the county.**

soils are in depressions or in drainageways between the gently sloping soils of the broad uplands. The Mequon soils and the Aztalan soils are somewhat poorly drained, and the Montgomery soils are poorly drained.

The nearly level to sloping soils of this association are in cultivated crops. The steeper Ozaukee soils are used for trees and recreational purposes.

The major soils of this association have slight limitations as sites for construction of reservoirs because the underlying silty clay loam till and lacustrine silt and clay are slowly permeable. Because this underlying material has a high shrink-swell potential, limitations are moderate for construction of roads and foundations of low buildings. Limitations for onsite sewage disposal are moderate to severe because of the slowly permeable underlying material and a high water table in the somewhat poorly to poorly drained soils.

4. Casco-Hochheim-Sisson Association

Well-drained soils that have a subsoil of loam to clay loam; over lake-laid silt and fine sand, in gravel and sand outwash, or in sandy loam glacial till, on uplands

This association consists of nearly level to steep soils that are underlain by calcareous materials. These materials are lacustrine silt and fine sand, outwash sand and gravel, and sandy loam or loam glacial till (see fig. 6, bottom). Most of the soils in this association are in the eastern half of the county. The sloping and rolling soils are intermingled on hills and ridges of the uplands. The drainage pattern in this association is fairly irregular.

This association occupies about 8 percent of the county. Casco soils make up about 30 percent of it; Hochheim soils, 20 percent; Sisson soils, 15 percent; and minor soils, 35 percent.

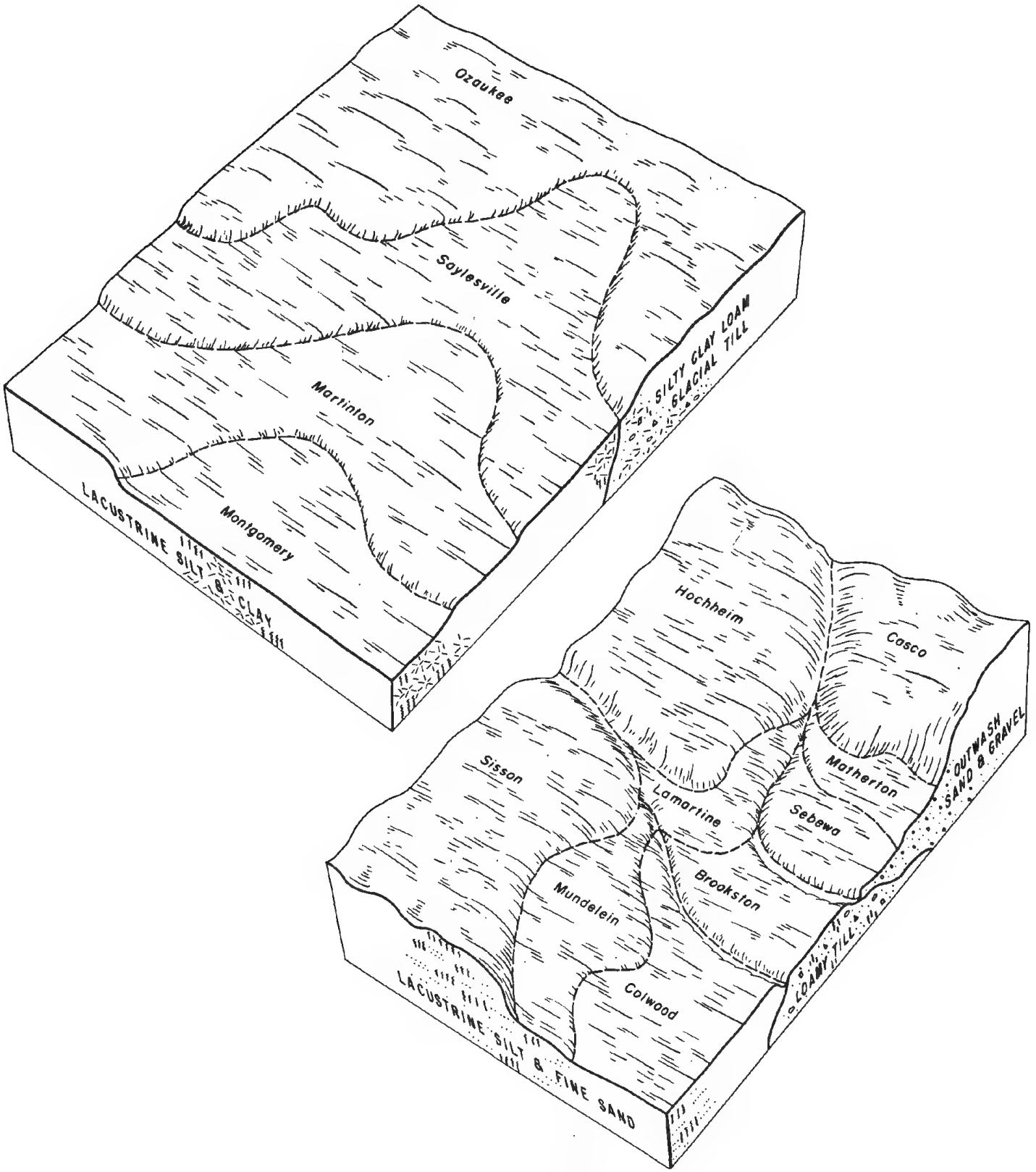

Figure 6.—Relationship of soils to landscape in soil association 3 (*top*) and in soil association 4 (*bottom*).

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The Casco soils have a loam and silt loam surface layer, and they are less than 20 inches deep over calcareous sand and gravel. The Hochheim soils have a loam and silt loam surface layer and are less than 24 inches deep over calcareous till that has sandy loam to loam texture. The Sisson soils have a fine sandy loam surface layer and are less than 40 inches deep over lacustrine silt and fine sand. In many places these soils grade toward Zurich soils, which are silt loam.

Minor soils in this association are in the Lamartine, Matherton, Sebewa, Mundelein, Colwood, and Brookston series. These soils are nearly level to gently sloping. They occur on foot slopes and in lowlands between the sloping to steep soils on hills and ridges of the uplands. During the wet periods, these minor soils have a water table at a depth of less than 3 feet.

The nearly level to sloping Casco, Hochheim, and Sisson soils are in corn, small grains, legumes, and other cultivated crops. The steeper soils are used for trees and recreational purposes. The Casco soils are a source of sand and gravel.

The major soils of this association generally have moderate to severe limitations as sites for construction of reservoirs because the underlying material is semipervious to pervious. In the well-drained soils the underlying material is stable and has slight limitations for construction of roads and foundations of low buildings. Limitations for onsite sewage disposal is slight on the well-drained Casco, Hochheim, and Sisson soils.

5. Colwood-Boyer-Sisson Association

Well-drained and poorly drained soils that have a subsoil of sandy loam or silty clay loam; over lake-laid silt and fine sand or gravel and sand outwash, on plains and dissected terraces

This association consists of nearly level to steep soils that are underlain by calcareous sandy outwash and lacustrine silt and fine sand (fig. 7, top). Soils in this association are generally in the northeastern part of the county. The nearly level soils are on outwash and lacustrine plains, and the sloping to steep soils are on lacustrine and outwash terraces that have been dissected by erosion. The drainage pattern is irregular.

This association occupies about 6 percent of the county. The Colwood soils make up about 30 percent of the association; the Boyer soils, 20 percent; the Sisson soils, 15 percent; and the minor soils, the remaining 35 percent.

The Colwood soils and the Sisson soils are loamy and are less than 40 inches thick over lacustrine silt and fine sand. The Sisson soils have a fine sandy loam surface layer, and the Colwood soils have a silt loam surface layer. Colwood soils are in lowlands along drainageways below the Sisson and the Boyer soils. Boyer soils have a loamy sand to sandy loam surface layer and are generally on the steeper slopes above the Sisson soils. They are less than 40 inches deep over sandy outwash.

Minor soils in this association are in the Wasepi and the Keowns series. These soils are nearly level and depressional and are on uplands between the Sisson and Boyer soils on hills and ridges. They have a water table that is less than 3 feet from the surface during wet periods.

The nearly level to sloping Sisson and Boyer soils and the drained areas of Colwood soils are in corn, small grains, legumes, and other cultivated crops. The steeper soils are droughty, are subject to soil blowing and water erosion, and are used for trees, wildlife habitat, and recreational purposes.

The major soils of this association have moderate to severe limitations as sites for construction of reservoirs because of the underlying semipervious silt and fine sand and pervious sand and gravel. On well-drained soils the sand and gravel is stable and has slight limitations for the construction of roads and foundations for low buildings. Limitations to such construction are severe on the Colwood soils because of a high water table. Limitations to onsite sewage systems are slight on the well-drained Sisson and Boyer soils but are severe on the poorly drained Colwood and other poorly drained and somewhat poorly drained soils.

6. Brookston-Pella-Lamartine Association

Somewhat poorly drained and poorly drained soils that have a subsoil of clay loam or silty clay loam; formed in loess and underlying loam to sandy loam glacial till

This association consists of nearly level to gently sloping soils that are underlain by calcareous loam to sandy loam glacial till. The soils of this association occur throughout the western two-thirds of the county. They occur on ground moraines. The topography consists mainly of low drainageways and some broad, irregular areas between uplands.

The soils in this association occupy about 6 percent of the county. The Brookston soils make up about 30 percent of the association; the Pella soils, 25 percent; the Lamartine soils, 12 percent; and the minor soils the remaining 33 percent.

The Brookstone, Pella, and Lamartine soils have a silt loam surface layer. The Brookston and Pella soils are poorly drained, and the Lamartine soils are somewhat poorly drained. In most places the Brookston soils are nearly level to gently sloping and are along narrow to irregular drainageways of the lowlands. They are as much as 40 inches deep and have 6 to 20 inches of loess over sandy loam to loam glacial till. The nearly level Pella soils are on broad to irregular lowlands. They are as much as 50 inches thick and have more than 36 inches of silty soil over sandy loam to loam glacial till. The Lamartine soils are generally nearly level to gently sloping and are along foot slopes of the uplands. They are as much as 42 inches thick and have 20 to 30 inches of silty soil over sandy loam to loam glacial till.

Minor soils in this association are in the Kendall and Palms series. These soils are underlain by loamy glacial till.

Where the soils in this association are adequately drained, they are in corn, small grains, and other culti-

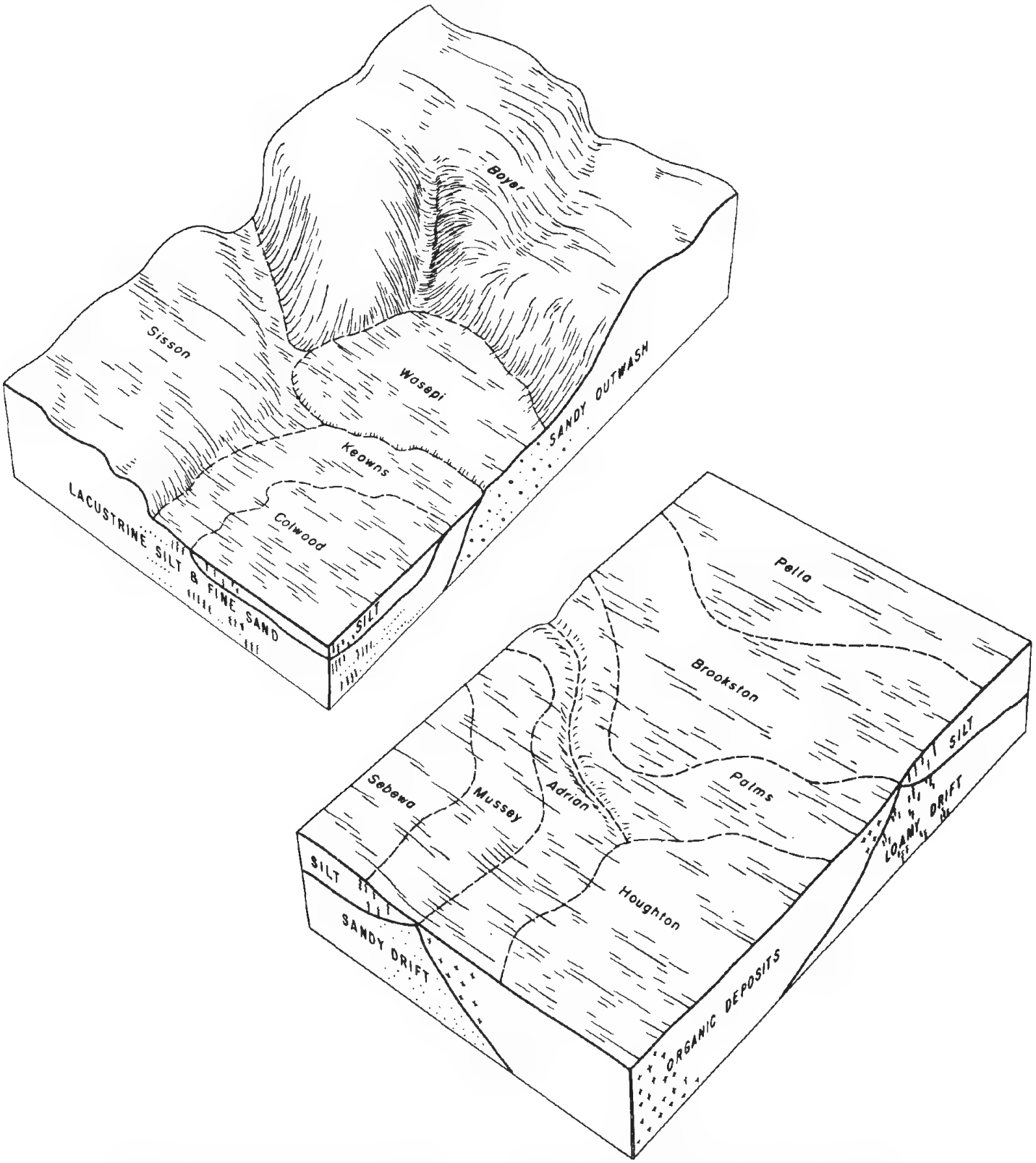

Figure 7.—Relationship of soils to landscape in soil association 5 (*top*) and in soil association 7 (*bottom*).

vated crops. Areas not cultivated are used as woodlots, for permanent pasture, or as wildlife habitat.

The major soils of this association have very severe limitations for use as onsite sewage disposal systems because the water table is less than 24 inches from the surface during wet periods. Because of a high water table and possible flooding, these soils have severe limitations as sites for roads and foundations for low buildings. Limitations for construction of reservoirs are slight because of the high water table.

7. Houghton-Palms-Adrian Association

Very poorly drained organic soils along drainageways, in depressions, and in old lakebeds

This association consists of nearly level organic soils (see fig. 7, bottom). The soils in the association generally occur throughout the county on lowlands that in most places are along drainageways and in old lake basins or small depressions (fig. 8).

These soils occupy about 6 percent of the county. The Houghton soils make up about 40 percent of the association; the Palms soils, 30 percent; the Adrian soils, 10 percent; and minor soils, the remaining 20 percent.

The Houghton soils occur in the larger organic areas of the county. They contain more than 42 inches of organic deposits over sandy to loamy materials. The Palms soils are shallower than the Houghton and are generally in narrow drainageways and small depressions or along the outer margins of the Houghton soils. Palms soils formed in less than 42 inches of organic deposits over loamy materials. The Adrian soils are also shallower than the Houghton soils and, like the Palms soils, are in small depressions along narrow drainageways or along the outer margins of the larger areas of the Houghton soils. Adrian soils formed in less than 42 inches of organic deposits over sandy soils.

Minor soils in this association are in the Pella, Brookston, Mussey, and Sebewa series. These soils are poorly drained. They are generally around the extreme outer margins of the organic soils or in the lowlands adjacent to the areas of organic soils.

Because of the high water table, which is less than 2 feet from the surface much of the year, the major soils of this association have very severe limitations as sites for foundations of low buildings or for onsite sewage disposal systems. These soils have only slight limitations as sites for development of habitat for waterfowl and furbearers because water is available and dugout ponds can be constructed. In most adequately drained areas, corn, sod crops, vegetables, and other crops can be grown. In other places the soils in this association are idle or are used for permanent pasture, trees, or wildlife.

Use and Management of the Soils

The soils of Washington County are used mostly for cultivated crops and pasture. This section discusses the use of soils for these main purposes, and it gives predicted yields of principal crops and pasture. Also described are use of soils for trees, for recreational facilities, for wildlife, and for building highways, farm ponds, and other engineering structures.

Figure 8.—Nearly level organic soils in soil association 7 on lowlands along the Rock River.

Use and Management for Crops and Pasture

About 75 percent of the acreage of Washington County is used as cropland. Oats, alfalfa, and corn are the main crops. Grown to a lesser extent are wheat, barley, rye, potatoes, peas, sweet corn, and red beets.

This subsection explains the system of land classification used by the Soil Conservation Service. It also describes management practices that are suitable for groups of soils having similar properties, limitations to use, and management requirements. Also given are predicted yields of the principal crops and pasture plants grown in the county under two levels of management.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or engineering.

In the capability system, all kinds of soils are grouped at three levels, the capability class, subclass, and unit. These are discussed in the following paragraphs.

Capability Classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife. (None in Washington County.)

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts, of the United States, but not in Washington County, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

Capability Units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–1 or IIIe–3. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages the capability units in Washington County are described and suggestions for the use and management of the soils are given.

Management by capability units

The soils in Washington County have been placed in 23 capability units. The soils in each unit have about the same limitations, are subject to similar risks of damage, need about the same kind of management, and respond to management in about the same way. The capability units are not numbered consecutively, because not all the units used in Wisconsin are in this county.

Discussed for each unit are the characteristics of the soils in the unit and the suitability of these soils for crops. Management is suggested for units consisting of soils suitable for cultivation, except those soils chiefly limited by erosion or the susceptibility to erosion. These are the units in subclasses IIe, IIIe, and IVe. If used for cultivated crops, the soils in these units require erosion control practices that include contour stripcropping (fig. 9), use of diversion terraces and grassed waterways, and use of a cropping system that includes close-growing crops, such as small grains, grasses, and legumes. Adding manure, using cover crops, and returning crop residues to the soil are practices that also help to control erosion,

Figure 9.—Stripcropping on Hochheim silt loam on a sloping to moderately steep ground moraine.

and they supply organic matter, help to improve fertility, and preserve good tilth as well.

In the uplands most pastures on well-drained soils in classes II, III, IV, or VI require renovation for maintaining fertility. A good seedbed must be prepared, and a suitable mixture of grasses and legumes must be seeded. A suitable mixture for seeding is alfalfa and bromegrass or timothy. Also suitable is a mixture of birdsfoot trefoil and bromegrass. The pasture should be seeded with a companion crop of oats. The oats provide a protective cover for the first season and thus help to control erosion.

On the steep soils in class VI, pastures are difficult to renovate, and the soils in class VII are not suitable for renovation. Tillage is not practical on class VII soils, and pastures are kept in native grasses. Adding commercial fertilizers helps to maintain fertility, and controlling grazing helps to lessen erosion. Preferred to renovating pastures is topdressing with fertilizers each year because this practice helps to preserve the sod.

The soil series represented in each capability unit are named in the description of the unit, but this does not mean that all the soils of a given series appear in the unit. To find the names of the soils in any given unit, refer to the "Guide to Mapping Units" at the back of this survey.

CAPABILITY UNIT I–1

This unit consists of well drained and moderately well drained, nearly level loams and silt loams. These soils are in the Dodge, Grays, Hochheim, Juneau, Mayville, Sisson, St. Charles, Theresa, and Zurich series. They have medium to very high available water capacity and moderate to high natural fertility. They are easy to manage and keep in good tilth. The Juneau soil is slightly susceptible to erosion because of concentrated runoff from steeper adjacent slopes.

The soils in this unit are used mainly for corn, small grains, and forage crops, as well as for peas and other specialty crops. They are suitable for use as woodland and for growing plants that provide food for migratory waterfowl and food and cover for upland game and songbirds.

The soils in this unit require only ordinary practices of good management to insure good growth of crops.

CAPABILITY UNIT IIe–1

In this unit are well drained and moderately well drained, gently sloping loams and silt loams. These soils are in the Dodge, Grays, Hochheim, Mayville, Sisson, St. Charles, Theresa, and Zurich series. They have medium to very high available water capacity and high natural fertility. They are subject to moderate erosion but are easy to keep in good tilth.

The soils in this unit are used mostly for cultivated crops, and are mainly in corn, small grains, grasses, and legumes. They are suitable as woodland and for growing plants that provide food for migratory waterfowl and food and cover for songbirds and upland game.

Controlling erosion is especially important on the shallow Hochheim soils.

CAPABILITY UNIT IIe–2

In this unit are gently sloping, well drained and moderately well drained silt loams and fine sandy loams of the Fox, Knowles, and Sisson series. These soils have medium to high available water capacity, but during extended dry periods, they are somewhat droughty. They have moderate natural fertility and are moderately susceptible to erosion.

The soils in this unit are used mostly for corn, small grains, grasses, and legumes. They are suitable for use as woodland and for growing plants that provide food and cover for songbirds, upland game, and migratory waterfowl.

CAPABILITY UNIT IIe–3

In this unit are gently sloping, well drained to moderately well drained loam and silt loam soils of the Hebron, Ozaukee, and Saylesville series. These soils have very high available water capacity. They have moderate to high natural fertility and are moderately susceptible to erosion.

The Ozaukee and Saylesville soils are slow to dry in spring or after a heavy rain. If these fine-textured soils are cultivated when wet, they puddle easily.

Most areas of the soils in this unit are used for cultivated crops, mainly corn, small grains, grasses, and legumes. They are suited to trees and can be used for growing plants that provide food for migratory waterfowl and food and cover for songbirds and upland game.

CAPABILITY UNIT IIw–1

In this unit are nearly level to gently sloping, poorly drained silt loams and silty clay loams that are in the Ashkum, Brookston, Montgomery, Otter, and Pella series. These soils have high to very high available water capacity and high natural fertility. A high water table prevents downward movement of water.

Where these soils are adequately drained, they can be cultivated intensively and are well suited to corn, small grains, and legumes. They also are well suited to trees and can be used for growing plants that provide food and cover for upland game, furbearers, and migratory waterfowl.

Where outlets are available, excess water can be removed by tile or surface drainage. In many places diversions and grassed waterways also can be used to supplement drainage. Good structure can be maintained by adding organic matter and by working the soils only when they are dry enough not to puddle.

CAPABILITY UNIT IIw–2

In this unit are nearly level and gently sloping, somewhat poorly drained loams, fine sandy loams, and silt loams. These soils are in the Aztalan, Darroch, Drummer, Kendall, Lamartine, Martinton, Mequon, Mundelein, Nenno, and Radford series. They have high to very high available water capacity. Except for the Nenno soils, these soils have high natural fertility. Natural fertility is somewhat lower in the Nenno soils.

Where adequately drained, the soils in this unit are well suited to corn, small grains, and legumes. They also are well suited to trees and can be used for growing plants that provide food and cover for songbirds, migratory waterfowl, and furbearers.

Where outlets are available, these soils are suited for tile or surface drainage. In places diversions and grassed waterways also can be used to supplement drainage. Good structure can be maintained by adding organic matter and working the soil only when it is dry enough not to puddle.

CAPABILITY UNIT IIw–3

In this unit are nearly level and gently sloping, poorly drained and somewhat poorly drained loams and silt loams. These soils are in the Colwood, Fabius, Matherton, Mussey, Sebewa, Virgil, and Yahara series. They have medium to very high available water capacity and low to moderate natural fertility.

Where adequately drained, these soils are suited to corn, small grains, and legumes. They also are suited to trees and can be used to grow plants that provide food and cover for songbirds, migratory waterfowl, and furbearers.

Open ditches and surface drainage can be used on these soils. Some areas are suitable for tile drainage if the tile is blinded. Diversions and grassed waterways also can be used to supplement drainage. Good structure is maintained by adding adequate amounts of organic matter and by working the soil only when it is dry enough not to puddle.

CAPABILITY UNIT IIw–4

In this unit are nearly level to gentle sloping, moderately well drained and poorly drained soils formed in alluvium and colluvium. These soils are Alluvial land, Wallkill silt loam, and Palms mucky peat. They are susceptible to periodic flooding along streams and rivers. These soils have high to very high available water capacity and moderate to high natural fertility.

Where adequately drained and protected from stream overflow, these soils are suited to corn, small grains, and legumes. Areas not protected from flooding are well suited to forage plants, trees, or wildlife.

Open ditches and surface drainage can be used on these soils. In places where outlets are feasible, the Wallkill soils also are suitable for tile drainage. Diversions can be used on these soils to divert runoff from other soils. Maintaining content of organic matter and practicing minimum tillage are ways to maintain good soil structure.

CAPABILITY UNIT IIs–1

In this unit are nearly level, well drained and moderately well drained silt loams of the Dresden and Fox series. These soils have medium available water capacity, but they are somewhat droughty during extended dry periods. They have moderate natural fertility.

These soils can be used intensively for corn, small grains, and forage crops. They are well suited to trees and can be used to grow plants that provide food for migratory waterfowl and food and cover for songbirds and upland game.

The soils in this unit require practices that conserve moisture such as use of crop residue, plow planting, and stripcropping.

CAPABILITY UNIT IIs–2

In this unit are nearly level, well drained to moderately well drained loam and silt loam soils in the Hebron and Saylesville series. These soils have very high available water capacity and moderate to high natural fertility.

The soils in this unit, especially the Saylesville soil, are slow to dry in spring or after a heavy rain. They puddle easily if cultivated when wet.

Most areas of these soils are used for corn, small grains, grasses, and legumes. They are suited to trees or can be used for growing plants that provide food for migratory waterfowl and food and cover for songbirds and upland game.

Care should be taken not to work these soils before they dry out in spring or after a heavy rain.

CAPABILITY UNIT IIIe–1

In this unit are well drained and moderately well drained, eroded, sloping silt loam and loam soils. These soils are in the Casco, Hochheim, Sisson, Theresa, and Zurich series. They have medium to very high available water capacity and moderate natural fertility. The hazard of further erosion is severe.

The soils in this unit are used mostly for cultivated crops, mainly corn, small grains, grasses, and legumes. They are suited to permanent pasture or trees and can be used for growing plants that provide food and cover for songbirds and upland game.

CAPABILITY UNIT IIIe–2

In this unit are sloping, well-drained and somewhat excessively drained silt loam, loam, fine sandy loam, sandy loam, and loamy sand soils on uplands. These soils are in the Boyer, Casco, Knowles, Ritchey, and Sisson series. They are droughty but have medium to high available water capacity. Natural fertility is moderate. Also moderate are the hazards of water erosion and soil blowing.

These soils are used mostly for corn, small grains, and legumes. They are suited to trees and for growing plants that provide food for migratory waterfowl and food and cover for songbirds and upland game.

The construction of diversion terraces on the Knowles soil to help control erosion may be difficult because the Knowles soil includes areas where dolomite bedrock is

at the surface. Maintaining a high level of organic matter helps to maintain soil structure and conserve moisture.

CAPABILITY UNIT IIIe–3

Ozaukee silt loam, 6 to 12 percent slopes, eroded, is the only soil in this unit. This soil is well drained to moderately well drained. It has very high available water capacity and high natural fertility. The hazard of erosion is severe if this soil is cultivated and not protected. It is susceptible to puddling if cultivated when wet.

This soil is used mostly for cultivated crops, mainly corn, small grains, and legumes. It is well suited to trees and can be used for growing plants that provide food for migratory waterfowl and food and cover for songbirds and upland game.

CAPABILITY UNIT IIIw–1

Houghton mucky peat is the only soil in this unit. It is a nearly level, very poorly drained organic soil of the lowlands. This soil has high available water capacity and low natural fertility. The hazard of soil blowing is moderate in drained areas that are not protected by windstrips or by shelterbelts. This soil is underlain by organic material and is more susceptible to subsidence and soil blowing than soils underlain by loamy material.

Where the soils in this unit are drained and soil blowing is controlled, row crops can be grown year after year. Small grains and forage crops are also grown. Some areas are used for sod crops and specialty crops, and these soils can be used for growing plants that provide food and cover for migratory waterfowl. Controlling the water table helps to prevent subsidence of these soils. Areas not drained are well suited to pasture, as woodland, or as wildlife habitat.

CAPABILITY UNIT IIIs–1

In this unit are nearly level, well-drained and somewhat excessively drained loam and sandy loam soils in the Boyer and Casco series. These soils have medium available water capacity and low natural fertility. They are droughty and moderately susceptible to soil blowing and water erosion.

These soils are used for corn, small grains, and forage crops. They are suited to trees and can be used for growing plants that provide food for migratory waterfowl and food and cover for songbirds and upland game.

Soil moisture is conserved by maintaining content of organic matter, by good management of crop residue, and by using cover crops. These practices also help to control erosion.

CAPABILITY UNIT IVe–1

The soils in this unit are well-drained fine sandy loam, loam, and silt loam soils in the Casco, Hennepin, Hochheim, Ozaukee, and Sisson series. These soils are generally sloping to moderately steep and slightly to moderately eroded. An exception is the Hochheim soils, 6 to 12 percent slopes, severely eroded. The soils in this unit have low to very high available water capacity and moderate natural fertility. The hazard of further erosion is very severe. The Casco and Hennepin soils are especially droughty.

These soils are used for cultivated crops, such as corn, small grains, grasses, and legumes. They are used for trees and can be used for growing plants that provide food for migratory waterfowl and food and cover for songbirds and upland game.

CAPABILITY UNIT IVe–2

In this unit are well-drained to excessively drained, sloping loam, loamy sand, sandy loam, and silt loam soils that are shallow over sand and gravel or bedrock. These soils are in the Casco, Fox, Ritchey, and Rodman series. Except for the droughty Casco and Rodman soils, they have medium available water capacity. The natural fertility in these soils is low, and the hazard of soil blowing and water erosion is very severe.

The soils in this unit are used for corn, small grains, grasses, and legumes. They also are used for trees and can be used for growing plants that provide food for migratory waterfowl and food and cover for songbirds and upland game.

CAPABILITY UNIT IVw–1

In this unit are very poorly drained, poorly drained, and somewhat poorly drained, nearly level to gently sloping soils in the Adrian, Granby, Keowns, and Wasepi series. The Keowns, Granby, and Wasepi soils are loamy, and the Adrian soil is mucky peat. The soils in this unit have medium to high available water capacity and low natural fertility. A high water table prevents downward movement of water. On these soils surface drainage or open ditches can be used. In some areas tile drainage can be used if the tile is blinded and outlets are available.

Where these soils are adequately drained, they can be used for corn, small grains, and legumes. They are suited to trees and can be used for growing plants that provide food and cover for upland game, furbearers, and migratory waterfowl.

CAPABILITY UNIT VIe–1

In this unit are steep loam and silt loam soils that are moderately to severely eroded and a moderately steep loam that is severely eroded. These well-drained soils are in the Boyer, Casco, Hennepin, Hochheim, Ozaukee, and Sisson series. The Casco soils in this unit are more droughty and have lower fertility than the other soils in this unit. In some places the Ozaukee soils are very steep. The soils in this unit have low to very high available water capacity and moderate natural fertility. These soils are subject to severe erosion if the plant cover is not maintained.

Although the soils in this unit are not suited to tilled crops, pasture plants and trees can be grown, or these soils can be kept in permanent vegetation that provides food and cover for songbirds and upland game. In areas where slopes are not too steep, forage plants can be harvested for hay. Controlled grazing helps to lessen erosion.

CAPABILITY UNIT VIe–2

This unit consists of well-drained, moderately steep, eroded loamy soils of the Casco and Rodman series. These soils are droughty and have low to moderate natural fertility. The hazard of further erosion is severe if plant cover is not maintained.

The soils in this unit are used for pasture or hay crops. Trees also can be grown, or these soils can be kept in permanent vegetation that provides food and cover for songbirds and upland game. Controlled grazing helps to control erosion.

CAPABILITY UNIT VIIe–1

In this unit are moderately steep to very steep, well-drained to excessively drained loams and loamy sands. These soils are in the Casco, Hennepin, Hochheim, and Rodman series. They have low to high available water capacity and low to moderate natural fertility. Many of the soils are droughty, and the hazard of erosion is severe.

The soils in this unit are well suited to trees and can be used to grow permanent vegetation that provides food and cover for wildlife. If used for pasture, management that controls grazing helps to maintain the vegetative cover and to control erosion.

CAPABILITY UNIT VIIIw–1

In this unit are very poorly drained and poorly drained Marsh, Wet alluvial land, and the acid variant of the Houghton series. The acid variant is difficult to drain, has low natural fertility, and is extremely acid. Marsh is flooded most of the time and generally is not suitable for drainage because of its position. Wet alluvial land is along streams and is frequently flooded and difficult to drain.

On the land types and soil in this unit, trees have only limited growth, but areas are suitable for use as wildlife habitat.

CAPABILITY UNIT VIIIs–1

In this unit are cut and filled areas of Loamy land and Sandy and gravelly land. These land types contain raw, infertile soil material on which harvestable vegetation seldom grows. They generally are graded for vehicular traffic or for building sites.

Predicted Yields

Table 1 gives predicted average yields per acre for principal field and forage crops grown in Washington County. The predictions are based on interviews with farmers, on results obtained by the agricultural experiment station, and on observations made by soil surveyors and other agricultural workers who are familiar with the crops of the county. Not listed in table 1 are Houghton peat, acid variant, most of the complexes that have slopes of more than 20 percent, and the land types in the county. These mapping units generally are not suited to the crops and to hay and pasture for which yields are predicted.

The yields in table 1 are for two levels of management. The columns marked "Average" list yields to be expected under the kind of management most farmers were practicing when the survey was made. The columns marked "High" list yields to be expected under the improved management used by some farmers in the county.

For corn grown under management that gives average yields, about 12,000 plants of hybrid corn per acre are grown. Barnyard manure and commercial fertilizer are applied as a starter. For seeding of oats or alfalfa-bromegrass, little or no fertilizer is applied. No special practices are used for preparing the seedbed or in cultivating. Hay is cut twice each year, and the field is grazed in fall.

The management used to obtain the yields in columns marked "High" is better than that used to obtain average yields. For corn, it includes (1) adding large amounts of manure and returning all crop residue to the soil; (2) applying commercial fertilizer according to the needs of the crop to be grown; (3) adding lime in amounts indicated by the results of soil tests; (4) growing about 18,000 plants per acre on the best soils and fewer plants on the more droughty soils; and (5) using a suitable conservation cropping system and seeding, spraying, and cultivating at the right time.

For oats, management needed for obtaining the yields in the columns marked "High" consists of planting good seed of a variety suited to the soil and of applying commercial fertilizer according to the results of soil tests. For alfalfa-bromegrass, management includes (1) adding lime and fertilization as needed each year, (2) using adapted varieties, and (3) using grazing practices suggested in the subsection "Management by capability units."

Use of the Soils as Woodland

Forest originally covered most of Washington County, but during the past century much of it has been cleared, mainly to make room for farming. About 39,600 acres, or about 14 percent of the county, now is woodland. Much of this woodland is on farms and is privately owned. Five sawmills operate in the county.

Growing on most of the woodland are northern hardwoods, mainly hard maple, red oak, basswood, and white oak. The main trees on the lowlands are American elm, soft maple, and black ash.

In managed stands the growth rate of trees is relatively high in the county. By using a high level of management an increase of 3 to 7 percent in annual volume growth can be obtained. Grazing and indiscriminate cutting reduce productivity.

If the woodland in the county is to produce at its potential, management must be at a high level. Trees must be protected from fire and grazing, cull trees removed, and other measures of good woodland management practiced.

Woodland groups

By placing the soils in Washington County in woodland groups owners of woodland are assisted in planning the use of their soils. Each group is made up of soils that have about the same characteristics that influence the growth of trees. The soils also have similar limitations and are subject to about the same hazards when used for trees. All of the soils in one group, therefore, support similar kinds of trees, have about the same potential productivity, and require similar kinds of management.

The kind and quantity of wood products that can be grown in a given area largely determine the kind of management that should be used. Not all soils produce alike; productivity may range from none to several hundred board feet per acre annually. Soils suitable for pine may not be suitable for spruce. Soils that now grow

TABLE 1.—*Predicted average acre yields of the principal crops under two levels of management*

[Absence of yield indicates the soil is not suitable for the crop or that the crop is ordinarily not grown]

Soil	Corn		Oats		Alfalfa-bromegrass hay		Alfalfa-bromegrass pasture	
	Average	High	Average	High	Average	High	Average	High
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Adrian mucky peat						3.0	8	125
Ashkum silty clay loam, 0 to 3 percent slopes	70	95	50	65		4.0	85	135
Aztalan loam, 0 to 2 percent slopes	65	105	50	60	2.5	4.5	85	140
Aztalan loam, 2 to 6 percent slopes	60	100	45	55	2.5	4.0	80	135
Boyer loamy sand, 2 to 6 percent slopes	45	60	30	45	1.0	2.0	65	90
Boyer loamy sand, 6 to 12 percent slopes	40	55	25	40	0.5	1.5	60	80
Boyer sandy loam, 0 to 2 percent slopes	55	70	40	55	1.5	2.5	75	115
Boyer sandy loam, 2 to 6 percent slopes	50	65	35	50	1.5	2.5	70	110
Boyer complex, 6 to 12 percent slopes, eroded	40	55	25	40	0.5	1.5	60	80
Boyer complex, 12 to 30 percent slopes, eroded							60	80
Brookston silt loam, 0 to 3 percent slopes	75	115	50	65		4.0	75	135
Casco loam, 0 to 2 percent slopes	55	75	45	60	1.7	2.5	80	115
Casco loam, 2 to 6 percent slopes, eroded	45	70	40	55	1.5	2.5	75	120
Casco loam, 6 to 12 percent slopes, eroded	40	65	35	50	1.5	2.0	70	100
Casco loam, 12 to 20 percent slopes, eroded					1.5	2.0	65	95
Casco sandy loam, 2 to 6 percent slopes, eroded	50	65	30	45	1.5	2.5	65	115
Casco sandy loam, 6 to 12 percent slopes, eroded	40	55	25	35	0.5	1.5	55	90
Casco-Fox loams, 6 to 12 percent slopes, eroded	40	70	40	55	1.5	2.0	80	115
Casco-Rodman complex, 6 to 12 percent slopes, eroded	30	50	25	40	1.0	1.5	65	95
Casco-Rodman complex, 12 to 20 percent slopes, eroded							55	90
Colwood silt loam	75	115	50	65		4.0	75	135
Darroch fine sandy loam, neutral variant, 0 to 3 percent slopes	70	95	45	65	3.0	4.0		
Dodge silt loam, 0 to 2 percent slopes	80	115	65	80	3.0	4.5	100	145
Dodge silt loam, 2 to 6 percent slopes	80	110	60	75	3.0	4.5	95	145
Dresden silt loam, 1 to 3 percent slopes	65	100	55	70	2.5	3.5	80	130
Drummer silt loam, gravelly substratum	70	110	45	65		4.0		
Fabius loam, 1 to 3 percent slopes	55	80	50	65	2.5	3.5	85	130
Fox silt loam, 0 to 2 percent slopes	65	100	55	70	2.5	3.5	85	130
Fox silt loam, 2 to 6 percent slopes	60	95	50	65	2.0	3.0	70	125
Granby fine sandy loam, 0 to 3 percent slopes	45	65	40	50		3.0	75	120
Grays silt loam, 0 to 2 percent slopes	75	100	55	75	3.0	4.5	95	135
Grays silt loam, 2 to 6 percent slopes	70	95	50	70	3.0	4.5	95	135
Hebron loam, 0 to 2 percent slopes	80	110	55	70	3.0	4.5	100	145
Hebron loam, 2 to 6 percent slopes	75	105	50	65	2.5	4.0	95	140
Hochheim loam, 2 to 6 percent slopes	70	95	55	70		4.5	90	145
Hochheim loam, 2 to 6 percent slopes, eroded	65	90	50	65	3.0	4.5	90	145
Hochheim loam, 6 to 12 percent slopes, eroded	65	90	50	65	2.5	4.0	85	140
Hochheim loam, 12 to 20 percent slopes, eroded	55	90	45	60	2.5	3.5	85	130
Hochheim loam, 20 to 30 percent slopes					2.0	2.5	75	113
Hochheim silt loam, 0 to 2 percent slopes	65	105	55	75	3.0	4.5	100	145
Hochheim soils, 6 to 12 percent slopes, severely eroded	50	80	40	50	2.0	3.0	70	120
Hochheim soils, 12 to 20 percent slopes, severely eroded					1.5	2.5	60	110
Hochheim-Hennepin complex, 12 to 20 percent slopes	45	80	40	50	2.0	3.0	75	115
Hochheim-Hennepin complex, 20 to 30 percent slopes							65	95
Houghton mucky peat						3.0	80	125
Juneau silt loam, 1 to 3 percent slopes	75	105	55	70	3.5	4.5	100	130
Kendall silt loam, 1 to 3 percent slopes	80	115	55	65	2.5	4.5	80	135
Keowns silt loam	65	95	45	60		3.5	80	120
Knowles silt loam, 1 to 6 percent slopes	60	85	50	70	2.5	3.5	70	135
Knowles silt loam, 6 to 12 percent slopes, eroded	50	75	40	60	2.0	3.0	65	125
Lamartine silt loam, 1 to 3 percent slopes	75	115	60	70	2.5	4.0	90	140
Martinton silt loam, 1 to 3 percent slopes	70	105	50	65	3.0	4.5	95	130
Matherton silt loam, 1 to 3 percent slopes	65	100	50	70	2.5	4.0	85	135
Mayville silt loam, 0 to 2 percent slopes	85	110	65	80	3.0	4.5	100	145
Mayville silt loam, 2 to 6 percent slopes	80	105	60	75	3.0	4.5	95	145
Mequon silt loam, 1 to 3 percent slopes	70	105	55	70	3.0	4.5	95	140
Montgomery silty clay loam	65	100	40	60		4.0	75	135
Mundelein silt loam, 1 to 3 percent slopes	70	100	45	65	3.0	4.5		
Mussey loam, 0 to 3 percent slopes	55	85	40	55		2.5	60	85
Nenno silt loam, 1 to 3 percent slopes	70	105	55	75	3.5	4.5	100	145
Otter silt loam	75	110	55	65		4.0	85	135

See footnote at end of table.

TABLE 1.—*Predicted average acre yields of the principal crops under two levels of management*—Continued

Soil	Corn		Oats		Alfalfa-bromegrass hay		Alfalfa-bromegrass pasture	
	Average	High	Average	High	Average	High	Average	High
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Cow-acre-days* [1]	*Cow acre-days* [1]
Ozaukee silt loam, 2 to 6 percent slopes	65	100	50	70	3. 0	4. 5	80	130
Ozaukee silt loam, 2 to 6 percent slopes, eroded	60	90	45	65	2. 5	4. 0	75	125
Ozaukee silt loam, 6 to 12 percent slopes, eroded	50	80	40	60	2. 0	3. 5	75	125
Ozaukee silt loam, 12 to 20 percent slopes, eroded	40	75	35	55	2. 0	3. 0	70	120
Ozaukee silt loam, 20 to 35 percent slopes					2. 0	2. 5	70	115
Palms mucky peat						3. 0	75	115
Pella silt loam	75	115	55	65		4. 0	85	135
Radford silt loam, 0 to 3 percent slopes	70	105	50	75	3. 0	4. 0	95	140
Ritchey silt loam, 2 to 6 percent slopes	50	60	50	65	2. 5	3. 0	80	115
Ritchey silt loam, 6 to 12 percent slopes, eroded	40	50	40	55	1. 5	2. 0	75	100
St. Charles silt loam, gravelly substratum, 0 to 2 percent slopes	80	115	60	75	3. 0	4. 5	90	140
St. Charles silt loam, gravelly substratum, 2 to 6 percent slopes	75	110	55	70	2. 5	4. 5	85	140
St. Charles silt loam, 0 to 2 percent slopes	80	115	65	75	3. 0	4. 5	100	145
St. Charles silt loam, 2 to 6 percent slopes	80	115	65	75	3. 0	4. 5	100	145
Saylesville silt loam, 0 to 2 percent slopes	70	95	55	75	3. 0	4. 5	90	140
Saylesville silt loam, 2 to 6 percent slopes	65	85	50	70	3. 0	4. 5	90	140
Sebewa silt loam	65	90	45	65		4. 0	75	135
Sisson fine sandy loam, 2 to 6 percent slopes	70	95	50	70	3. 0	4. 5	100	140
Sisson fine sandy loam, 6 to 12 percent slopes, eroded	60	85	45	60	2. 5	3. 5	75	125
Sisson fine sandy loam, 12 to 20 percent slopes, eroded	55	80	40	55	2. 0	3. 0	70	120
Sisson-Casco-Hochheim complex, 0 to 2 percent slopes	65	90	45	65	2. 5	4. 0	85	135
Sisson-Casco-Hochheim complex, 2 to 6 percent slopes, eroded	60	85	40	60	2. 5	4. 0	90	135
Sisson-Casco-Hochheim complex, 6 to 12 percent slopes, eroded	45	70	30	45	2. 0	3. 0	65	115
Sisson-Casco-Hochheim complex, 12 to 20 percent slopes, eroded					1. 5	2. 0	65	95
Sisson-Casco-Hochheim complex, 20 to 30 percent slopes					2. 0	2. 5	65	110
Theresa silt loam, 0 to 2 percent slopes	75	110	55	75	3. 0	4. 5	95	135
Theresa silt loam, 2 to 6 percent slopes	70	100	50	65	2. 5	4. 5	90	135
Theresa silt loam, 2 to 6 percent slopes, eroded	65	95	45	60	2. 5	4. 0	85	130
Theresa silt loam, 6 to 12 percent slopes, eroded	55	85	30	50	2. 0	3. 0	75	120
Virgil silt loam, gravelly substratum, 0 to 3 percent slopes	80	115	55	70	3. 0	4. 5	90	135
Wallkill silt loam	80	105	40	60				
Wasepi sandy loam, 1 to 3 percent slopes	45	60	35	50	1. 5	2. 5		
Yahara silt loam, 1 to 3 percent slopes	65	90	45	65		4. 0		
Zurich silt loam, 0 to 2 percent slopes	75	100	55	75	3. 0	4. 5	100	140
Zurich silt loam, 2 to 6 percent slopes	70	95	50	70	3. 0	4. 5	100	140
Zurich silt loam, 2 to 6 percent slopes, eroded	65	90	45	65	3. 0	4. 5	90	140
Zurich silt loam, 6 to 12 percent slopes, eroded	60	85	40	60	2. 5	4. 0	85	135

[1] Cow-acre-days is a term used to express the carrying capacity of pasture. It is the number of animal units carried per acre multiplied by the number of days that the pasture can be grazed during a single grazing season without injury to the sod. An acre of pasture that provides 30 days of grazing for 2 cows has a carrying capacity of 60 cow-acre-days.

trees of low quality may be good sites for black walnut or other trees that are highly prized. It is, therefore, important to learn as much as possible about the suitability of soils for different trees. Information given in the woodland groups can be used along with other information in the soil survey to determine the kind of trees that grow well on a particular soil. It can also be used to determine the special hazards related to the soil and the kind of management needed.

In the descriptions of each woodland group, the soils in the groups are briefly described, and the main trees grown on them are named. Also, hazards to use as woodland are rated. The hazards rated are seedling mortality, or the loss of seedlings as related to the kinds of soils; the risk of plant competition, or competition from undesirable plants; the limitations to the use of equipment; the hazards to seedlings from disease, insects, or animals; and the hazards of windthrow and erosion. A rating of *slight* means that no special problems are recognized and that the use of soils in the group for trees would not be affected, except as noted, by the particular hazard. A rating of *moderate* means that the use of the soils for trees would be affected by the stated hazard, but not to the extent of precluding such use, and that ordinary management practices can be used to control the hazard. A rating of *severe* means that the stated hazard makes

it impractical to manage the soils for trees, or that the difficult or expensive practices are required for control of the hazard.

Because the woodland groups are numbered according to a statewide system, they are not in consecutive order.

WOODLAND GROUP 1

Woodland group 1 consists of moderately deep to deep, moderately well drained to well drained, medium-textured soils that developed under forest vegetation on uplands.

On these soils the principal trees are mixed hardwoods, mainly hard maple, red oak, and basswood. The hardwood stands should be managed for the production of saw logs or veneer of high quality. Hard maple normally is preferred.

Hardwood plantings in open areas generally have been unsuccessful, but hard maple, white ash, and black walnut are suitable for interplanting. Plantings of white pine, Norway spruce, and white spruce are suitable for producing timber. White pine, white spruce, and white cedar are satisfactory for use in farm windbreaks.

Competition from grasses, weeds, and brush is severe unless adequate control measures are taken. Where the sites are prepared before planting, scalping, furrowing, clean tillage, applying herbicides, or similar practices reduce competition from grasses and weeds. This reduction of competition also helps to reduce the number of field mice and other rodents that injure young plantings.

Frost, frost heaving, and drowning are only slight hazards to the establishment of trees. Heat or drought normally is a slight hazard. Damage by insects is moderate, except in grassy areas where white grubs may seriously damage tree roots. Shoot moths may be a problem in pine plantation. Deer and rabbits may severely damage new seedlings in local areas.

Equipment use is limited only by temporary wetness caused by heavy rains or spring thaws. If the logging operations necessary in harvesting trees are performed in winter, the soil is compacted less than it would be if the logging were done in other seasons.

WOODLAND GROUP 2

Woodland group 2 consists of moderately deep to deep, moderately well drained to well drained soils that have a medium-textured surface layer and a fine-textured subsoil and substratum. These soils developed under forest vegetation.

On these soils the principal trees are mixed hardwoods, mainly hard maple, red oak, and basswood.

Hardwood plantings in open areas generally have been unsuccessful. Hard maple and white ash are suitable for interplanting. Hardwood stands should be managed for the production of saw logs or veneer of high quality. Hard maple normally is preferred.

Plantings of white pine and the spruces are suitable for producing timber. White pine, white spruce, and white cedar are satisfactory for use in farm windbreaks.

Competition from grasses, weeds, and brush is severe unless adequate control measures are taken. Where the sites are prepared before planting, practices that reduce plant competition are scalping, furrowing, clean tillage, or applying herbicides. Reducing competition from grasses also helps to reduce damage by field mice and other rodents. Damage from insects is slight, except in grassy areas where white grubs may seriously damage tree roots. Deer and rabbits may severely damage seedlings.

Unless proper planting methods are used, frost heaving is a severe hazard to the establishment of trees. Heat, drought, and drowning are slight hazards.

The use of mechanical planters on these clayey soils is severely limited. By plowing and disking these soils before planting, tilth is improved and tree survival is increased.

WOODLAND GROUP 3

Woodland group 3 consists of moderately deep to deep, well-drained to somewhat excessively drained, moderately coarse textured soils that developed under forest vegetation.

On these soils the natural stands are predominantly red oak, hard maple, hickory, and other hardwoods. Where natural stands occur, management to favor existing trees is needed. Saw logs, fuelwood, and posts are the principal woodland products.

If protected, plantings of jack pine, white pine, and hardwoods grow fairly well on these soils. Jack pine and redcedar are used to establish cover. Droughty soils and soil blowing make plantings difficult to establish.

WOODLAND GROUP 4

In woodland group 4 are somewhat excessively drained soils that are calcareous at a depth of 18 inches or less. On these soils trees grow fairly well. Growing naturally are red oak, white oak, hickory, and hard maple.

The high content of carbonates and droughtiness limit the kinds of trees that can be planted on these soils. Jack pine grows well on the soils of this group, and white pine grows well on cooler sites. Red oak and hard maple can be underplanted to bring the stocking rates to a desirable level.

Native hardwoods should be favored. They are used for posts, fuelwood, or saw logs of poor quality.

WOODLAND GROUP 5

Woodland group 5 consists of thin, somewhat excessively drained to well-drained soils that are calcareous at a depth of less than 18 inches. These soils, which developed under trees, are well suited to the production of wood crops.

Red oak, white oak, and hard maple grow in natural stands on these soils. The principal woodland products are fuelwood, posts, and saw logs.

Stones, the high content of carbonates, and droughtiness limit the kinds of trees that can be grown. Hardwoods, mainly red oak and hard maple, can be planted under a protective cover to bring the stocking rate to a desirable level. Jack pine and redcedar provide protective cover in the steeper areas.

Competition from grasses, weeds, and brush is moderate unless adequate control measures are used. Where the sites are prepared before planting, scalping, furrowing, clean tillage, and applying herbicides are practices that reduce competition from grasses and weeds. Reducing competition from grasses helps to lessen damage by field mice and other rodents that injure young plantings.

Frost, frost heaving, and drowning are only slight

hazards to the establishment of trees. Damage by insects generally is moderate, but white grubs severely damage tree roots in grassy areas. Also, deer and rabbits may severely damage new seedlings.

The use of mechanical equipment is limited in some places by stones and steep slopes. Hazards are severe if mechanical planters are used. Damage by compaction can be reduced by logging during dry periods.

WOODLAND GROUP 7

Woodland group 7 consists of shallow to deep, somewhat poorly drained to very poorly drained soils that are moderately coarse to fine textured. These soils of the lowlands developed under forest cover. They are moderately well suited to trees.

The main trees growing on these soils are American elm, black ash, and other swamp hardwoods. These trees are used for posts, fuelwood, and saw logs. Many of the saw logs are defective because fungi have caused the wood to rot. Management that favors the existing native trees is needed.

Many severe hazards limit the establishment and growth of trees on these soils. Drowning, frost heaving, and plant competition are hazards to seedlings. Severe hazards to the use of mechanical equipment limit the removal of logs and the restocking of trees. Overmature trees often reduce production and increase the hazard of windthrow.

WOODLAND GROUP 9

Woodland group 9 consists of somewhat poorly drained and very poorly drained soils formed in alluvium.

The trees growing on these soils are mainly elm, ash, and other swamp hardwoods. Saw logs and fuelwood are the principal woodland products.

Drowning is a severe hazard on these soils because they are frequently flooded. Tall weeds and brush compete severely with desirable trees. The trees are of poor quality and commonly are infested with root rot.

White cedar is suitable for planting on these soils. Willows can be used to protect the streambanks. Maintaining the original cover of hardwoods is desirable.

Machine planting is hazardous on these soils, and the harvesting of timber is limited to dry periods or to periods when the ground is frozen.

WOODLAND GROUP 10

Woodland group 10 consists of organic soils. The native vegetation growing on these soils consists mainly of elm, white ash, black ash, white cedar, and marsh grasses. The suitability of these soils for trees varies considerably because of microrelief and the variable depth of the organic material.

The mortality of tree seedlings is high because late freezing temperatures are common. Seedlings are also killed by drought and the fluctuating water table. Windthrow is a severe hazard, but it can be reduced by adjusting the method of harvesting.

Tree planting ordinarily is not practical, because planting by machines is not feasible and planting by hand is difficult.

WOODLAND GROUP 11

Woodland group 11 consists of land types on which trees do not grow well.

The native vegetation is limited to small shrubs, grasses, and scattered small trees. The hazards that limit the establishment of seedlings are severe, and these land types generally are not suitable for wood production.

The value as wildlife areas or for watershed protection should be the primary consideration in planning use and treatment of these land types. In all management the existing cover should be maintained.

Recreational Uses of the Soils

Recreation and the use of soils for recreational purposes are becoming more important in Washington County. This subsection, therefore, is provided to assist in planning the use of soils for recreational facilities.

The soils in Washington County have been placed in 13 recreation groups according to the degree of limitation affecting their use for recreation. In table 2, these groups of soils are briefly described, the degree of limitation for specified recreational facilities is rated, and important properties that determine these limitations are listed. These ratings and properties are helpful in predicting the behavior of the groups of soils where used for the facilities specified. In table 2, the listing of the soil series represented in a recreation group does not mean that all the soils in the series are in the group. To find the soils in any group, refer to the "Guide to Mapping Units" at the back of this survey.

The facilities rated in table 2 are for outdoor recreation. They are playgrounds, athletic fields, and other intensive play areas; picnic areas, parks, and other extensive play areas; bridle paths and nature and hiking trails; golf fairways; cottages and service and utility buildings; and sites for tents and camp trailers.

Four degrees of limitations are used in this table. A rating of *slight* means that the soils have no limitations or have limitations for a given use that are easy to overcome. A rating of *moderate* indicates that the soils have limitations for a given use that can be overcome by good management and careful design. A rating of *severe* means that the soils have limitations for a given use that are difficult to overcome. A rating of *very severe* indicates that the soils have limitations that generally preclude use for a given purpose.

In evaluating limitations for recreation groups, consideration was not given to esthetic qualities, because these qualities vary from place to place for the same kind of soil. Also not considered because they vary were the size and shape of the soil areas and the pattern that these areas form with areas of other soils. All of these factors, however, are important and must be considered before a final evaluation is made.

The degree of limitations given in table 2 applies only to soils that are not eroded or are slightly eroded to moderately eroded. Generally, the severely eroded soils are more severely limited than are the less eroded ones.

For poorly drained soils in table 2, the ratings given are for undisturbed soils that have not been artificially drained. If drainage is improved, these soils can be used for many kinds of recreational developments. Soils subject to flooding vary considerably in their degree of limitations.

For intensive play areas, including playgrounds and athletic fields, the sites are assumed to be 2 acres or more

TABLE 2. *-Degree of limitations for*

Recreation group	Playgrounds, athletic fields, and other intensive play areas	Picnic areas, parks, and other extensive play areas
Group 1: shallow to deep, very poorly drained, nearly level organic soils of the lowlands. (Adrian, Houghton, Palms, Marsh)	Very severe: high water table; poor trafficability where wet; sod easily damaged; susceptible to soil blowing.	Very severe: high water table; poor trafficability where wet; sod easily damaged; susceptible to soil blowing.
Group 2: shallow to deep, well drained and moderately well drained, nearly level to very steep, loamy soils of the uplands. (Dodge, Fox, Hochheim, St. Charles, Theresa)	Slight on slopes of 0 to 2 percent, moderate on slopes of 2 to 6 percent, severe on slopes of 6 to 12 percent, and very severe on slopes of more than 12 percent; erodible on slopes; soils compact easily when wet; extensive leveling exposes sandy and gravelly substratum in some places.	Slight on slopes of 0 to 6 percent; moderate on slopes of 6 to 12 percent, and very severe on slopes of more than 12 percent; unprotected areas damaged by erosion.
Group 3: shallow to deep, poorly drained, nearly level to gently sloping soils of the lowlands. (Ashkum, Brookston, Colwood, Drummer, Keowns, Montgomery, Mussey, Otter, Pella, Sebewa, Wet alluvial land)	Severe: high water table; poor trafficability where wet; sod easily damaged; periodic flooding along streams and rivers; compacts easily when wet.	Severe: high water table; poor trafficability when wet; sod easily damaged; periodic flooding along streams and rivers; compacts easily when wet.
Group 4: shallow to deep, well-drained to somewhat poorly drained, nearly level soils. (Alluvial land, Aztalan, Dresden, Fabius, Juneau, Kendall, Lamartine, Martinton, Matherton, Mequon, Mundelein, Nenno, Radford, Virgil, Yahara)	Moderate: seasonal high water table; compacts easily when wet; extensive leveling exposes sandy and gravelly substratum in some places.	Moderate: seasona high water table; compacts easily when wet.
Group 5: shallow to deep, somewhat excessively drained, nearly level to gently sloping, sandy soils. (Boyer, Casco, Rodman)	Moderate on slopes of 0 to 6 percent, severe on slopes of 6 to 12 percent, very severe on slopes of more than 12 percent; droughty; subject to soil blowing and water erosion; extensive leveling exposes sandy substratum in some places.	Moderate: droughty and subject to soil blowing and water erosion.
Group 6: shallow to moderately deep, well-drained and somewhat excessively drained, nearly level to sloping, sandy soils of the uplands. (Boyer, Casco, Hebron)	Slight on slopes of 0 to 2 percent, moderate on slopes of 2 to 6 percent, severe on slopes of 6 to 12 percent, and severe on slopes of more than 12 percent; slightly droughty; subject to soil blowing and water erosion; extensive leveling exposes sandy and gravelly substratum in some places.	Slight on slopes of 0 to 6 percent, moderate on slopes of 6 to 12 percent, and severe on slopes of 12 to 20 percent; slightly droughty; subject to soil blowing and water erosion.
Group 7: moderately deep to deep, moderately well drained and well drained, nearly level to moderately steep soils of the uplands. (Casco, Hochheim, Sisson, St. Charles, Zurich)	Slight on slopes of 0 to 2 percent, moderate on slopes of 2 to 6 percent, severe on slopes of 6 to 12 percent, and very severe on slopes of more than 12 percent; subject to erosion.	Slight on slopes of 0 to 6 percent, moderate on slopes of 6 to 12 percent, and severe on slopes of 12 to 20 percent; subject to erosion.

recreation groups of soils

Bridle paths and nature and hiking trails	Golf fairways	Cottages and service and utility buildings	Sites for tents and camp trailers
Very severe: high water table; poor trafficability; difficult to maintain.	Severe: high water table; turf easily damaged; poor trafficability when wet; very severe on marsh.	Very severe: high water table; subject to shrinkage; low bearing capacity; susceptible to soil blowing.	Very severe: sites remain wet and soft; poor trafficability.
Moderate: muddy and slippery when wet; sloping soils; erodible.	Slight on slopes of 0 to 6 percent, moderate on slopes of 12 to 20 percent, and very severe on slopes of 20 to 45 percent; unprotected areas damaged by erosion.	Slight on slopes of 0 to 6 percent, moderate on slopes of 6 to 12 percent, severe on slopes of 12 to 20 percent, and very severe on slopes of more than 20 percent; erodible on slopes; subject to frost heave.	Moderate on slopes of 0 to 6 percent, severe on slopes of 6 to 12 percent, and very severe on slopes of more than 12 percent; surface remains wet and soft after rains; compacts easily.
Severe: high water table; wet for long periods; muddy and slippery when wet; occasional overflow; difficult to maintain.	Severe: high water table; poor trafficability; turf easily damaged when wet.	Very severe: high water table; frequent flooding; sanitary systems do not work; liquifies easily; low bearing capacity when wet.	Very severe for Otter soils and Wet alluvial land, and severe for the rest of the soils in this group; sites remain wet and soft for long periods; poor trafficability when wet; compacts easily; periodic flooding.
Severe on Alluvial land, moderate on remaining soils of this group.	Moderate: seasonal high water table; turf easily damaged when wet; wet for short periods; muddy and slippery when wet; may require surfacing; sloping soils erodible.	Moderate for Dresden soils, severe for Juneau soils, and very severe for rest of soils in group; seasonal high water table restricts sanitary systems; low bearing capacity when wet; high shrink-swell potential; subject to frost heave.	Very severe for Alluvial land; severe for Juneau soils and moderate for rest of soils in group, sites remain wet and soft for long periods; compact easily; Alluvial land and Juneau soils are subject to periodic flooding.
Moderate: subject to soil blowing and water erosion; poor stability on slopes; difficult to maintain.	Severe: droughty and subject to soil blowing and water erosion; difficult to maintain a good turf.	Moderate: subject to soil blowing and water erosion; droughty; difficult to vegetate; possible contamination of ground water.	Moderate: subject to soil blowing and water erosion: droughtiness makes maintaining vegetative cover difficult.
Slight on slopes of 0 to 12 percent, moderate on slopes of 12 to 20 percent, and severe on slopes of 20 to 30 percent; slightly droughty and subject to soil blowing and water erosion.	Moderate on slopes of 0 to 12 percent and severe on slopes of 12 to 20 percent; slightly droughty; subject to soil blowing and water erosion; difficult to maintain a good turf.	Severe for Hebron soils; subsoil of Hebron soils has slow permeability that restricts sanitary systems, low bearing capacity when wet, high shrink-swell potential; slight for rest of soils of group on slopes of 0 to 6 percent, moderate on slopes of 6 to 12 percent, and severe on slopes of 12 to 20 percent; subject to soil blowing and water erosion; slightly droughty; possible contamination of ground water.	Slight on slopes of 0 to 6 percent, moderate on slopes of 6 to 12 percent, and severe on slopes of 12 to 20 percent; these soils are subject to soil blowing and water erosion.
Moderate on slopes of 0 to 12 percent and severe on slopes of 12 to 20 percent; muddy and slippery when wet; subject to erosion.	Slight on slopes of 0 to 6 percent; moderate on slopes of 6 to 12 percent, and severe on slopes of 12 to 20 percent; subject to erosion on slopes.	For Zurich silt loam, moderate on slopes of 0 to 12 percent and severe on slopes of 12 to 20 percent; liquefies easily; has low bearing capacity when wet; subject to erosion.	Moderate on slopes of 0 to 6 percent, severe on slopes of 8 to 12 percent, very severe on slopes of more than 12 percent; surface remains wet and soft for short periods after rains; walks and roads need surfacing.

TABLE 2.—*Degree of limitations for*

Recreation group	Playgrounds, athletic fields, and other intensive play areas	Picnic areas, parks, and other extensive play areas
Group 8: shallow to deep; moderately well and well drained; nearly level to sloping soils of the uplands. Some areas are underlain by bedrock. (Grays, Knowles, Mayville, Ritchey)	Slight on slopes of 0 to 2 percent, moderate on slopes of 2 to 6 percent, and severe on slopes of 6 to 12 percent; subject to erosion; compacts easily when wet; extensive leveling of Knowles soils exposes the limestone substratum.	Slight on slopes of 0 to 6 percent, moderate on slopes of 6 to 12 percent, and severe on slopes of 12 to 20 percent; subject to erosion; compacts easily; some areas of Knowles soils have bedrock outcrops.
Group 9: shallow to moderately deep over sand and gravel, well-drained, nearly level to moderately steep soils of the uplands. (Casco, Fox)	Slight on slopes of 0 to 2 percent, moderate on slopes of 2 to 6 percent, severe on slopes of 6 to 12 percent, and very severe on slopes of more than 12 percent; subject to erosion; extensive levelling exposes the sands and gravelly substratum.	Slight on slopes of 0 to 6 percent, moderate on slopes of 6 to 12 percent, and severe on slopes of 12 to 20 percent; subject to erosion where not protected.
Group 10: soils are shallow to moderately deep over sand or organic deposits, nearly level to gently sloping, soils of the lowlands. (Granby, Wallkill)	Severe: subject to high water table and frequent overflow; subject to erosion; Wallkill soils compact easily where wet.	Severe: frequent overflow and high water table; subject to erosion; Wallkill soils compact easily when wet.
Group 11: shallow to moderately deep, somewhat poorly drained, nearly level to gently sloping, sandy soils. (Darrock, Wasepi)	Moderate: subject to seasonal high water table; subject to erosion on unprotected areas.	Moderate: seasonal high water table; needs water management; unprotected areas are subject to erosion.
Group 12: moderately deep to glacial till or outwash, well drained and moderately well drained, nearly level to steep, clayey soils of the uplands. (Ozaukee, Saylesville)	Moderate on slopes of 0 to 6 percent, severe on slopes of 6 to 12 percent, and very severe on slopes of more than 12 percent; moderately slow permeability; subject to erosion; compacts easily where wet.	Slight on slopes of 0 to 6 percent, moderate on slopes of 6 to 12 percent, and severe on slopes of 12 to 20 percent, and very severe on slopes of more than 20 percent; moderately slow permeability; subject to erosion; compacts easily when wet.
Group 13: sandy to loamy miscellaneous land types. (Hennepin, Hochheim, Loamy land and Sandy and gravelly land) [1]	Moderate on slopes of 0 to 6 percent, severe on slopes of 6 to 12 percent, very severe on slopes of more than 12 percent; leveling difficult; droughty.	Moderate on slopes of less than 12 percent; severe on slopes of more than 12 percent; erosive; droughty.

[1] Ratings are only for Hennepin and Hochheim soils. The land types in this group are in cut and filled areas that have been graded or vehicular traffic or building sites in most places. The underlying materials in filled areas vary in depth and other characteristics.

in size. Required for these areas are nearly level soils that have firm surfaces and that are not flooded during periods of use. Areas should be free of coarse fragments and outcrops of rock. Soils not surfaced should be well suited to growth of vegetation.

For extensive play areas, such as picnic grounds and parks, requirements are similar to those for intensive play areas. Sites should be 3 to 5 acres or more in size. The most desirable soils are nearly level, have good drainage, are not flooded during periods of use, and are free of coarse fragments and outcrops of rock. Also, the soils should have a firm surface and be able to support plants that provide a good cover.

It is assumed that bridle paths, nature trails, and hiking trails are to be used as they occur naturally and that little soil will be moved. Soils that are well suited to these paths and trails must have good foot and hoof trafficability. These soils are well drained, loamy, and nearly level to sloping. They have stability, are not subject to erosion, and are free of coarse rock fragments, stones, and outcrops of rock. In some areas that have outstanding esthetic values, costs of building and main-

recreation groups of soils—Continued

Bridle paths and nature and hiking trails	Golf fairways	Cottages and service and utility buildings	Sites for tents and camp trailers
Moderate on slopes of 0 to 12 percent and severe on slopes of 12 to 20 percent; muddy and slippery when wet; subject to erosion; may need surfacing; some areas of Knowles soils have bedrock outcrops.	Slight on slopes of 0 to 6 percent, moderate on slopes of 6 to 12 percent, and severe on slopes of 12 to 20 percent; subject to erosion; in places the Knowles soils have bedrock outcrops.	Severe: Grays and Mayville soils have seasonal high water tables that restrict sanitary systems; low bearing capacity when wet; soils are erodible on slopes and are subject to frost heave; Knowles soils have bedrock that restricts sanitary systems and hinders excavation; contamination of ground water possible.	Moderate on slopes of 0 to 6 percent and severe on slopes of 6 to 12 percent; surface remains wet and soft after rains; compacts easily when wet; bedrock of the Knowles soils greatly restricts use.
Slight on slopes of 0 to 12 percent, moderate on slopes of 12 to 20 percent, and severe on slopes of 20 to 30 percent; subject to erosion where not protected.	Slight on slopes of 0 to 6 percent, moderate on slopes of 6 to 12 percent, and severe on slopes of 12 to 20 percent; erodible if slopes are not protected.	Slight on slopes of 0 to 6 percent, moderate on slopes of 6 to 12 percent, and severe on slopes of 12 to 20 percent; subject to erosion where slopes are not protected; possible contamination of ground water.	Slight on slopes of 0 to 6 percent; moderate on slopes of 6 to 12 percent, and severe on slopes of 12 to 20 percent; subject to erosion where slopes are not protected.
Moderate: high water table and frequent flooding; wet for long periods on Granby soils and for short periods on Wallkill soils; Wallkill soils are muddy and slippery when wet.	Severe: high water table and frequent flooding; low trafficability; turf easily damaged; needs drainage.	Very severe: high water table and frequent overflow, so sanitary systems will not function; Wallkill soils have a low bearing capacity when wet and are subject to shrinkage.	Severe for Granby soils and very severe for Wallkill soils; sites remain wet for long periods; poor trafficability when wet; remains soft and wet for long periods.
Slight: wet for short periods	Moderate: seasonal high water table; unprotected areas subject to erosion.	Very severe: seasonal high water table; sanitary systems do not work; soils liquefy easily; low bearing capacity when wet; subject to frost heave.	Moderate: sites remain wet for short periods.
Moderate on slopes of 0 to 12 percent; severe on slopes of 12 to 20 percent, and very severe on slopes of more than 20 percent; muddy and slippery when wet; subject to erosion on unprotected slopes.	Moderate on slopes of 0 to 12 percent and severe on slopes of 12 to 20 percent; unprotected areas are subject to erosion; moderately slow permeability; turf is easily damaged when wet.	Severe: slow permeability restricts sanitary systems; low bearing capacity when wet; high shrink-swell potential.	Moderate on slopes of 0 to 6 percent, severe on slopes of 6 to 12 percent, very severe on slopes of more than 12 percent; sites remain wet and soft for short periods; compacts easily.
Moderate: difficult to maintain on slopes.	Moderate on slopes of less than 12 percent, severe on slopes of more than 12 percent; erosive.	Slight on slopes of 0 to 6 percent, moderate on slopes of 6 to 12 percent, severe on slopes of more than 12 percent; leveling difficult.	Slight on slopes of 0 to 6 percent, moderate on slopes of 6 to 12 percent, severe on slopes of more than 12 percent; erosive.

taining trails may be high. On sloping soils the paths and trails should be placed on the contour to help control erosion. Slopes that vary in gradient may increase interest, but the slopes should not exceed 12 percent for long distances.

In rating limitations of soils used for golf fairways, consideration was given only to those features that affect fairways. Greens, traps, hazards, and tees are man-made, generally from disturbed, transported soil material. Soils well suited to fairways are well drained, are free of flooding during periods of use, and are firm and have good trafficability. Also, these soils are gently undulating and contain not more than a few coarse fragments and rock outcrops. They are suited to plants that make a good turf and to many kinds of trees and shrubs. Loamy soils are preferred, but if irrigated, coarser textured soils are equally suited. But poorly drained mineral and organic soils are severely limited, though they can be used for constructing ponds of esthetic value that also supply water for maintaining the turf. Sandy soils can be used for hazards or as a source of sand for greens.

For cottages and service and utility buildings, the

ratings apply to seasonal and year-round cottages, washrooms and bathhouses, and service buildings without public sewerage and water facilities. Soils desirable for these uses have good drainage, are suitable for absorbing waste from domestic systems of sewage disposal, are not subject to flooding, and are nearly level to gently sloping. They have low shrink-swell potential, high bearing capacity, and are not subject to liquefaction or frost heave. Also, the erosion hazard is slight or none, and a good plant cover can be supported. In addition, hard bedrock does not occur within 6 feet of the surface, and coarse fragments and stones are few. Consideration should be given to access roads, the beauty of the areas, the presence of trees or water areas, and to other features that add to the desirability of sites.

The ratings of limitations to use of soils as sites for tents and camp trailers are based on suitability of the soils for pitching tents and parking camp trailers and for other activity related to living outdoors for short periods. Well-suited soils need little site preparation and are suitable for parking automobiles and camp trailers in areas that are not surfaced. The soils are well

TABLE 3.—*Limitations to use of*

[Loamy land and Sandy and gravelly land generally are

Wildlife group	Migratory waterfowl (ducks-geese)	Upland game birds (grouse-quail-pheasant)
Group 1: Shallow to deep, well drained and moderately well drained, nearly level to steep loams and silt loams of the uplands. (Casco, Dresden, Dodge, Fox, Grays, Hebron, Hochheim, Juneau, Knowles, Mayville, Ozaukee, Ritchey, St. Charles, Saylesville, Sisson, Theresa, Zurich)	Moderate on slopes of 0 to 6 percent and severe on slopes of 6 to 12 percent; generally not suited to intensive cropping of seed and grain crops on slopes of more than 12 percent; poorly suited to wetland food and cover crops; open water areas hard to provide.	Slight on slopes of 0 to 6 percent, moderate on slopes of 6 to 12 percent, and severe on slopes of 12 to 20 percent; erodible in sloping areas if cultivated; generally not suited to intensive cropping of grain and seed crops on slopes of more than 12 percent.
Group 2: Shallow to deep, very poorly drained, nearly level to gently sloping mineral and organic soils of the lowlands. (Adrian, Ashkum, Aztalan, Brookston, Colwood, Drummer, Houghton, Keowns, Montgomery, Mussey, Palms, Pella, Sebewa)	Slight: drainage needed for grains, seed crops, and legumes; organic soils are subject to soil blowing if cultivated.	Moderate: drainage needed for grains, seed crops, and legumes; nesting sites periodically flooded; few suitable woodland plants; organic soils subject to soil blowing if cultivated.
Group 3: Shallow to deep, somewhat poorly drained, nearly level to gently sloping silt loams. (Kendall, Lamartine, Martinton, Matherton, Mequon, Nenno, Virgil)	Slight: drainage needed for good growth of grains, seed crops, and legumes.	Moderate: drainage needed for good growth of grains, seed crops, and legumes; few suitable woodland plants.
Group 4: Shallow over sand and gravel or glacial till; well-drained and somewhat excessively drained, nearly level to very steep sandy and loamy soils of the uplands. (Boyer, Casco, Fox, Hochheim, Hennepin, Rodman)	Very severe: open water areas hard to provide; not suited to wetland food and cover plants; poorly suited to intensive cropping of grain and seed crops on slopes of more than 12 percent; plant growth limited by droughtiness.	Slight on slopes of 0 to 6 percent, moderate on slopes of 6 to 12 percent, and severe on slopes of 12 to 20 percent; few suitable woodland species; soils erodible if cultivated; droughtiness limits choice of grain and seed crops; cover crops and wild herbaceous food plants not well suited.
Group 5: Moderately deep to deep, somewhat poorly drained and poorly drained, nearly level to gently sloping soils of the lowlands and adjacent slopes. (Alluvial land, Granby, Otter, Radford, Wallkill)	Moderate: frequent flooding restricts growth of grain and seed crops; drainage needed for good growth of grains, seed crops, and legumes; nesting sites are flooded; few suitable wetland plants.	Moderate for quail and pheasants and severe for grouse; frequent flooding restricts growth of grain and seed crops; drainage is needed for growth of grains, seed crops, and legumes; few suitable woodland plants; nesting sites flooded periodically.
Group 6: Moderately deep over silt and fine sand of sandy outwash; somewhat poorly drained, nearly level to gently sloping soils. (Darroch, Fabius, Mundelein, Yahara, Wasepi)	Slight: drainage needed for good growth of grains, seed crops, and legumes.	Moderate: drainage needed for good growth of grains, seed crops, and legumes.
Group 7: Very poorly drained, nearly level miscellaneous land types and extremely acid organic soils. (Houghton, Marsh, Wet alluvial land)	Severe: poorly suited to growth of grains, seed crops, and legumes; few suitable wetland food and cover plants.	Very severe: not suited to good growth of grains, seed crops, and legumes; very few suitable woodland plants.

drained and loamy and have good trafficability. They are not subject to flooding during periods of use. On the preferred sites, an adequate plant cover is easy to maintain, erosion is not a hazard, and the soils are level to gently sloping. Surfaces are free of coarse fragments, and bedrock does not restrict use.

Wildlife Management

The kinds and amounts of wildlife that can be produced and maintained in the county are largely determined by the kinds and amounts of vegetation the soils can produce and by the way the vegetation is distributed. Wildlife is influenced by topography and by such soil characteristics as fertility. Fertile soils are capable of more production than unfertile ones. The way soils are used and managed also has much to do with production of wildlife.

Table 3 is a convenient guide to wildlife management. It lists the soil series represented in each wildlife group. The listing of the series name does not mean that all the soils in the series are in the wildlife group. To find the

soils for kinds of wildlife

not suited as wildlife habitat and are not included in table]

Songbirds	Small game (rabbits-squirrels)	Big game (deer)	Furbearers (beaver-mink-muskrats)
Slight on slopes of 0 to 6 percent, moderate on slopes of 6 to 12 percent, and severe on slopes of 12 to 20 percent; sloping soils erodible if cultivated.	Slight on slopes of 0 to 12 percent, moderate on slopes of 12 to 20 percent, and severe on slopes of 20 to 30 percent; less cover and natural foods generally in steeper areas.	Slight on slopes of 0 to 12 percent, moderate on slopes of 12 to 20 percent, and severe on slopes of 20 to 30 percent; sloping soils are erodible if cultivated; less cover and natural foods generally in steeper areas.	Moderate on slopes of 0 to 6 percent, and severe on slopes of 6 to 12 percent; open water areas may be hard to provide.
Moderate: drainage needed for growth of grains and seed crops; poor growth of woodland plants for shrub and tree nesters; organic soils highly erodible if cultivated.	Moderate for rabbits; burrows and nests flood periodically; poor growth of woodland plants; severe for squirrels; no mast trees in most places; natural foods limited.	Moderate: drainage needed for the good growth of grains, grasses, and legumes; not suited to some legumes; poor growth of woodland food and cover plants; organic soils subject to soil blowing.	Slight: no major limitations; poor growth of woodland plants; suitable for beaver; moderate growth of food and cover plants.
Slight: no major soil limitations.	Slight for rabbits; moderate for squirrels; few suitable mast trees.	Slight: drainage needed for good growth of grains, grasses, and legumes.	Slight: open water areas may be hard to provide.
Slight on slopes of 0 to 6 percent, moderate on slopes of 6 to 12 percent, and severe on slopes of 12 or more percent; droughtiness limits growth of grains, seed crops, and cover and woodland plants; soils erodible if cultivated; choices of species of adapted plants limited.	Slight on slopes of 0 to 6 percent, moderate on slopes of 6 to 12 percent, and severe on slopes of 12 or more percent; on steep soils and in droughty areas a cover is not maintained and natural foods are not well suited; few species of adapted mast trees and plants.	Slight on slopes of 0 to 6 percent, moderate on slopes of 6 to 12 percent, and severe on slopes of 12 or more percent; cover is limited in droughty and steep areas, and in these areas woodland food plants, grains, grasses, and legumes are not well suited; soils erodible if cultivated.	Severe on slopes of 0 to 6 percent and very severe on slopes of more than 6 percent; source of water generally not available; droughtiness and low natural fertility limit growth of food and cover plants.
Moderate: frequent flooding restricts growth of grains and seed crops; drainage is needed for growth of grains and seed crops; ground nest sites are periodically flooded; few woodland plants.	Moderate for rabbits; burrows and nests are subject to periodic flooding; poor growth of woodland plants; severe for squirrels; no mast trees in most places; natural food limited.	Moderate: frequent flooding restricts growth of grains; drainage is needed for grains, grasses, and legumes; woodland food and cover plants grow poorly.	Slight: moderate growth of food and cover plants.
Slight: No major limitations----	Slight for rabbits and moderate for squirrels; few suitable mast trees.	Slight.	Slight.
Severe: poorly suited to growth of grains and seed crops and to woodland and wild food plants.	Severe: poorly suited to growth of natural food plants; no mast trees.	Severe: very little browse; poorly suited to grasses of cover crops.	Severe: few suited aquatic food plants and woodland plants.

soils in any group refer to the "Guide to Mapping Units" at the back of this survey.

Table 3 rates limitations for groups of soils used for supporting specified kinds of wildlife. The kinds of wildlife in the table are migratory waterfowl, including ducks and geese; upland game birds, such as grouse, quail, and pheasant; songbirds; small game, including rabbits and squirrels; big game, such as deer; and furbearers, such as beaver, mink, and muskrat.

The limitations for the soils in each wildlife group are rated slight, moderate, severe, and very severe. A rating of *slight* indicates that the soils are relatively free of limitations or have limitations that are easy to overcome. A rating of *moderate* shows that the soils can be readily used if well managed, but generally they are less productive than soils that have only slight limitations. A rating of *severe* indicates that the soils are of only limited use to the kind of wildlife specified, and they have limitations that are difficult to overcome. A rating of *very severe* indicates that the soils can provide little or none of the habitat required.

In evaluating limitations of wildlife groups, no consideration was given to the size and shape of the soil areas, or to the pattern on the landscape that these areas form with areas of other soils. These factors must be considered when an evaluation is made of an area consisting of two or more kinds of soil.

Consideration also must be given to sources of water and to the area or home range needed by the individual species. Because wild animals are mobile, they can make use of the most desirable habitat on a number of different soils. A game bird, for example, may nest in one area, feed in another, and find protective cover in still another. A variety of soils within the home range of a given species normally provides the most productive habitat.

The degrees of limitations given in table 3 do not apply to severely eroded soils. They apply only to soils that are slightly eroded to moderately eroded. Generally, the severely eroded soils are more severely limited than are the less eroded ones, because the severely eroded soils do not produce as much vegetation that furnishes food and cover.

The overall ratings for the groups of soils are based on major habitat requirements of the different species. Only the major limitations for wildlife uses are given for the soils.

For migratory waterfowl the most desirable soils are nearly level and are well suited to intensive cropping of grains, seed crops, grasses, legumes, and wild herbaceous food plants. Shallow water areas are relatively easy to provide, and desired water levels are not difficult to maintain. Wood ducks generally need nesting places or trees in addition to other habitat requirements. Woodcock, herons, bitterns, and cranes are marsh and shore birds that require about the same habitat as migratory waterfowl.

Two different kinds of habitat were considered for upland game birds, one for grouse and the other for quail and pheasants. Although the habitat requirements are somewhat different, the capacity of soils to produce the required habitat is similar. The most desirable soils for upland game birds have slopes of less than 6 percent, are not droughty, and are not erodible if cultivated. They are well suited to grains, seed crops, legumes, wild herbaceous plants, and woody plants. The soils are not subject to frequent flooding, have good natural drainage, and are relatively free of stones or bedrock. Climate limits the kinds of food and cover plants that grow on some soils.

Hungarian partridge and prairie chicken require about the same kind of habitat as quail and pheasants, but sharp-tailed grouse requires habitat that includes elements needed by both prairie chicken and ruffed grouse.

Individual species of songbirds are not rated in the column headed "Songbirds." The most productive soils are those that provide habitat for large numbers and for many kinds of songbirds. Most desirable are soils on slopes of less than 6 percent that have good natural drainage and can grow good grain, seed crops, wild herbaceous plants, and woody plants.

The most productive soils for small game have slopes of less than 12 percent. They also have good natural drainage, are moderately fertile, and produce plants that provide food and cover for upland game. On these soils good growth is expected from a variety of shrubs, thickets, mast trees, and den trees. The soils are not droughty, excessively stony, or subject to frequent, prolonged flooding.

Cottontail rabbits and squirrels require dry nesting places, escape lanes, and plants that provide food and cover.

For big game the most productive soils have slopes of less than 12 percent. They have fair to good natural drainage and are not subject to flooding. Good growth of grains, grasses, legumes, and woodland food plants can be obtained. Land use and cover patterns are especially important in evaluating deer habitat in broad areas.

For beaver, mink, and muskrat an important concern is the availability of a dependable water supply. Soils that are well suited have slopes of less than 6 percent and are in areas where a suitable water habitat is easy to provide. The soils also should be moderately fertile and suited to many kinds of aquatic plants that supply food and cover.

Mink, raccoon, and skunk are not entirely dependent on water habitat, but they frequently prefer to live around the edges of bodies of water.

Engineering Uses of the Soils

Some properties of soils are of special interest to engineers because they affect the construction and maintenance of roads and streets, airports, pipelines, foundations for buildings, facilities for storing water, structures for controlling erosion, drainage systems, and sewage disposal systems. Among the properties most important to the engineer, which are considered in the interpretations of soils used in engineering, are permeability, shear strength, compaction characteristics, soil drainage, shrink-swell characteristics, grain size, plasticity, and reaction. Also important are relief, depth to the water table, hazard of flooding, and depth to bedrock or to sand and gravel.

The information in this subsection can be used with other information in the survey to—

1. Make soil and land use studies that will aid in selecting and developing sites for industries, businesses, residences, and recreational areas.
2. Make preliminary estimates of the engineering properties of soils in planning agricultural drainage systems, farm ponds, irrigation systems, and diversion terraces.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting locations for highways, railroads, airports, pipelines, and cables and in planning detailed investigations at the selected locations.
4. Locate probable sources of gravel and other construction materials.
5. Correlate performance of engineering structures with soil mapping units to provide information for overall planning that will be useful in designing and maintaining certain engineering practices and structures.
6. Determine the suitability of soil mapping units for cross-country movement of vehicles and construction equipment.
7. Supplement information obtained from other published maps and reports, and from aerial photographs, for the purpose of preparing maps that can be used readily by engineers.
8. Develop other preliminary estimates for construction purposes pertinent to the area.

With the use of soil map for identification, the engineering interpretations in this subsection can be useful for many purposes. It should be emphasized, however, that the interpretations may not eliminate the need for sampling and testing at the site chosen for specific engineering work that involves heavy loads or at a site where excavations are to be deeper than the depths of layers here reported. Also, the engineer should not apply specific values in pounds per square foot to the adjective ratings for bearing capacity given in this survey. Nevertheless, by using this survey, an engineer can select and concentrate on those soil units most important for his proposed kind of construction, and in this manner he can reduce the number of samples taken for laboratory testing and complete an adequate soil investigation at minimum cost.

In addition to this subsection, other sections of this survey, including "Descriptions of the Soils" and "Formation, Morphology, and Classification of Soils", are useful to engineers.

Some of the terms used by the soil scientist may be unfamiliar to the engineer, and some terms—for example, soil, clay, silt, and sand—may have special meanings in soil science. These and other terms used in this soil survey are defined in the Glossary at the back of the survey.

Much of the information in this subsection is given in tables 4, 5, and 6. Table 4 contains test data for soils of five series in the county. In table 5 the properties of the soils that are important to engineering are estimated. Table 6 indicates the suitability of the soils for various engineering uses.

Engineering classification systems

Soil scientists of the United States Department of Agriculture classify soils according to texture. In this system the textural class of a soil is based on the proportions of sand, silt, and clay in the soil (*5*).[1] In some ways this system of naming textural classes is comparable to the two systems engineers most commonly use in classifying soils.

Most highway engineers classify soil materials in accordance with the system approved by the American Association of State Highway Officials (*1*). In this system soil materials are classified on the basis of gradation, liquid limit, and plasticity index into seven principal groups. The groups range from A-1, which consists of soils that have high bearing capacity, and that are the best soils for subgrades, to A-7, which consists of clayey soils that have low strength when wet and that are the poorest soils for subgrades. Within each group the relative engineering value of the soil material is indicated by a group index number. The numbers range from 0 for the best materials to 20 for the poorest. For the soils tested, the group index numbers are shown in parentheses after the soil group symbol in table 4. Some engineers prefer to use the Unified classification system (*7*). In this system soils are identified on the basis of texture, plasticity, and performance as material for engineering construction. Soil materials are identified as coarse grained (eight classes), fine grained (six classes), and highly organic. In table 4 the last column gives the classification of the tested soils according to the Unified system.

Engineering test data

In table 4 are engineering test data for representative soils in Washington County. These soils were tested in accordance with standard procedures to help evaluate the soils for engineering purposes. The results of these tests are based on laboratory analyses of soil samples taken from the major horizons of the representative soils. In some soils not all of the major horizons were sampled.

Compaction (moisture-density) values for the tested soils are given in table 4. If soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the optimum moisture content is reached. After that, the density decreases with increase in moisture content. The highest dry density obtained in the compaction test is called maximum dry density. Moisture-density data are important in earthwork, for as a rule, optimum stability is obtained if the soil is compacted to about the maximum dry density when it is at approximately the optimum moisture content.

The engineering classifications in table 7 are based on data obtained by mechanical analyses and by tests to determine liquid limit and plastic limit. The mechanical analyses were made by the combined sieve and hydrometer methods. Percentage of silt and clay determined by the hydrometer method should not be used in naming textural classes for soil classification. The information, however, is useful in determining general engineering properties of the soils.

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[1] Italic numbers in parentheses refer to Literature Cited, p. 103.

TABLE 4.—*Engineering test data*

[Tests performed by State Highway Commission of Wisconsin in cooperation with the U.S. Department of Commerce, Bureau of Public figures indicates information

Soil name and location	Parent material	Depth from surface	SCS Report No.	Moisture-density data [1]		Mechanical analysis [2]		
				Maximum dry density	Optimum moisture	Percentage passing sieve—		
						3 in.	1½ in.	¾ in.
		Inches	*S64-Wi-*	*Lb. per cu. ft.*	*Percent*			
Dodge silt loam:								
SW¼NE¼ sec. 32, T. 6 N., R. 18 E. (Modal).	Silty material over loamy glacial till.	21–29	66–10–2	105	29			
		46–60	66–10–2	133	10	100	84	66
SW¼SW¼ sec. 28, T. 12 N., R. 18 E. (Silt mantle thinner than in modal).	Silty material over loamy glacial till.	27–37	66– 9–9					
		41–60	66– 9–2			100	95	94
Knowles silt loam:								
NE¼NE¼ sec. 28, T. 9 N., R. 20 E. (Modal).	Silty material over dolomite.	24–32	66– 6–1	98	25			
SW¼NE¼ sec. 9, T. 9 N., R. 20 E. (Solum thinner than in modal).	Silty material over dolomite.	17–27	66– 5–1					
NW¼SW¼ sec. 15, T. 9 N., R. 20 E. (Silt mantle thinner than in modal).	Silty material over dolomite.	18–26	66– 7–1					
Ozaukee silt loam:								
SE¼SE¼ sec. 13, T. 9 N., R. 20 E. (Modal).	Thin silty material over clay loam to silty clay loam till.	17–27	66– 8–1	98	25			
		27–50	66– 8–2	105	18			
SW¼SE¼ sec. 11, T. 6 N., R. 20 N. (Subsoil coarser textured than in modal).	Thin silty material over clay loam to silty clay loam till.	10–16						
		23–40						
Rodman gravelly sandy loam:								
SE¼NE¼ sec. 19, T. 12 N., R. 19 E. (Modal).	Thin gravelly loam over sand and gravel.	6–20	66– 4–2			100	91	88
Theresa silt loam:								
NW¼SE¼ sec. 8, T. 9 N., R. 20 E. (Modal).	Silty material over loamy glacial till.	17–27	66– 3–1	105	20			
		29–50	66– 3–2	140	7	100	88	79
SE¼NE¼ sec. 22, T. 10 N., R. 18 E. (Silt mantle thinner than in modal).	Silty material over loamy glacial till.	16–26	66– 1–1					
		33–50	66– 1–2			100	90	77
SW¼SW¼ sec. 19, T. 10 N., R. 19 E. (Substratum finer textured than in (modal).	Silty material over loamy glacial till.	22–28	66– 2–1					100
		30–50	66– 2–2			100	92	84

[1] Based on the Moisture-Density Relations of Soils Using 5.5-lb. Rammer and 12-in. Drop. AASHO Designation T 99–57, Method C (*1*).

[2] Mechanical analyses according to the AASHO Designation T 88. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

for representative soils

Roads (BPR) in accordance with the standard procedures of the American Association of State Highway Officials (AASHO). Absence of was not available or not obtained]

Mechanical analysis [2]—Continued								Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Continued—				Percentage smaller than—						AASHO [3]	Unified [4]
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
	100	98	96	94	71	37	30	42	20	A–7–6(12)	CL
50	45	38	28	27	10	7	6	26	8	A–2–4(0)	GC
	100	93	67	64	57	41	34	37	20	A–6(10)	CL
89	86	77	53	46	33	18	12	17	4	A–4(4)	ML–CL
	100	93	71	68	59	45	40	46	25	A–7–6(14)	CL
	100	96	72	71	60	45	40	44	24	A–7 6(14)	CL
	100	85	58	54	45	32	27	35	16	A–6(7)	CL
	100	98	91	90	86	67	56	56	32	A–7–6(19)	CH
	100	96	88	86	77	52	39	38	18	A–6(11)	CL
100	98	91	75			54		47	22	A–7–6(14)	CL
100	96	92	82			42		23	9	A–4(3)	CL
79	75	65	8	5	2	1	1		[5] NP	A–3(0)	SP–SM
	100	94	68	61	51	37	33	41	22	A–7–6(11)	OL
69	65	54	32	27	17	8	6		NP	A–2–4(0)	SM
	100	92	63	60	54	42	36	39	21	A–6(10)	CL
61	56	45	26	22	13	5	3		NP	A–1–b(0)	SM
97	93	84	62	60	49	33	27	38	18	A–6(9)	CL
73	67	58	37	33	22	8	4		NP	A–4(0)	SM

[3] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 8): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHO Designation M 145–49 (*1*).

[4] Based on the Unified Soil Classification System, Technical Memorandum No. 3–357, v. 1, Waterways Experiment Station, Corps of Engineers, March 1953(*7*). Soil Conservation Service and the Bureau of Public Roads have agreed to consider that all soils having plasticity indexes within 2 points from A-line are to be given a borderline classification, for example, SP–SM.

[5] NP=Nonplastic.

TABLE 5.—*Estimated engineering*

[The land types Alluvial land (Am); Loamy land (Lu); Sandy and gravelly land (Sf); and Wet alluvial land

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	Classification
			Dominant USDA texture
	Feet	*In.*	
Adrian: Ak	<1	0–22	Mucky peat
		22–60	Sand
Ashkum: AtA	<1	0–9	Silty clay loam
		9–26	Silty clay
		26–60	Silty clay loam
Aztalan: AzA, AzB	1 to 3	0–11	Loam
		11–28	Sandy clay loam to silty clay
		28–60	Silty clay loam
Boyer: BmB, BmC, BnA, BnB, BrC2, BrE2	>5	0–17	Loamy sand
		17–25	Sandy clay loam
		25–60	Sand and gravel
Brookston: BsA	<1	0–13	Silt loam
		13–28	Clay loam
		28–60	Gravelly loam
Casco: CcB2, CcC2, CeA, CeB2, CeC2, CeD2, CkC2, CrC2, CrD2, CrE. (For properties of Fox soil in CkC2, and the Rodman soil in CrC2, CrD2, and CrE, see the Fox and Rodman series respectively.)	>5	0–10	Loam
		10–17	Sandy clay loam
		17–60	Sand and gravel
Colwood: Cw	<1	0–28	Silt loam
		28–60	Silt and fine sand
Darroch: DaA	1 to 3	0–11	Fine sandy loam
		11–18	Loam
		18–60	Fine sandy loam
Dodge: DdA, DbB	>5	0–10	Silt loam
		10–32	Silty clay loam
		32–60	Loam
Dresden: DsA	>5	0–14	Silt loam
		14–25	Silty clay loam
		25–32	Clay loam
		32–60	Sand and gravel
Drummer: Dt	<1	0–11	Silt loam
		11–16	Silty clay loam
		16–50	Silt loam
		50–60	Sand and gravel
Fabius: FaA	1 to 3	0–18	Loam
		18–60	Sand and gravel
Fox: FsA, FsB	>5	0–10	Silt loam
		10–24	Silty clay loam
		24–31	Sandy loam
		31–60	Sand and gravel
Granby: GfA	<1	0–11	Fine sandy loam
		11–60	Sand
Grays: GrA, GrB	>5	0–8	Silt loam
		8–27	Silty clay loam
		27–60	Silt and fine sand
Hebron: HeA, HeB	>5	0–12	Loam
		12–27	Silty clay loam
		27–60	Silt and clay

See footnotes at end of table.

properties of the soils

(Ww) are not listed because they are extremely variable. The symbol > indicates more than; < less than]

Classification—Continued		Percentage passing sieve [1]—			Permeability	Available water capacity	Reaction	Shrink-swell potential
Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)				
					In. per hr.	*In. per in.*	*pH*	
Pt					2. 0–6. 3	>0. 20	7. 4–7. 8	
SP	A 3	100	100	5	6. 3–20. 0	. 04	7. 4–8. 4	Low.
CL	A–6	100	95	95	0. 63–2. 0	. 20	7. 4–8. 4	Moderate.
CH	A–7	95	95	90	0. 20–0. 63	. 18	7. 4–7. 8	High.
CL	A–6	95	90	90	0. 20–0. 63	. 16	7. 4–8. 4	Moderate.
ML	A–4	100	95	55	0. 63–2. 0	. 20	7. 4–8. 4	Moderate.
CL	A–6	100	95	85	0. 63–2. 0	. 18	7. 4–7. 8	Moderate.
CL	A–6	100	100	95	0. 20–0. 63	. 18	7. 4–8. 4	Moderate.
SM	A–2	100	95	20	6. 3 –20. 0	. 07	6. 6–7. 3	Low.
SC	A–2	95	90	30	2. 0–6. 3	. 16	6. 1–7. 3	Low.
GP–GM	A 1	50	45	5	>20. 0	. 04	7. 4–8. 4	Very low.
ML	A–4	100	100	95	0. 63–2. 0	. 24	7. 4–8. 4	Low.
CL	A–6	100	100	70	0. 63 2. 0	. 18	7. 4–8. 4	Moderate.
SM	A–4	80	75	45	0. 63–2. 0	. 10	7. 4–8. 4	Low.
ML	A–4	95	85	60	0. 63–2. 0	. 20	7. 4–7. 8	Low.
CL	A–6	95	85	55	0. 63–2. 0	. 16	6. 6–7. 8	Moderate.
GP–GM	A–1	50	45	5	>20. 0	. 02	7. 4–8. 4	Very low.
ML	A–4	100	100	80	0. 63–2. 0	. 22	7. 4–8. 4	Low.
ML	A–4	100	100	80	0. 63–2. 0	. 16	7. 4–8. 4	Low.
SM	A–4	100	100	45	0. 63–2. 0	. 12	7. 4–7. 8	Low.
CL	A–4	95	95	60	0. 63–2. 0	. 16	6. 6–7. 3	Low.
SM	A–2	100	90	30	0. 63–2. 0	. 12	7. 4–8. 4	Low.
ML	A–4	100	100	95	0. 63–2. 0	. 22	6. 6–7. 3	Low.
CL	A–6	100	95	90	0. 63–2. 0	. 18	6. 1 7. 3	Moderate.
ML	A–4	95	95	55	0. 63–2. 0.	. 16	7. 4–8. 4	Low.
ML	A–4	100	100	95	0. 63 2. 0	. 20	7. 4 7. 8	Low.
CL	A–6	100	100	95	0. 63–2. 0	. 18	6. 1–7. 3	Moderate.
CL	A–6	95	95	70	0. 63–2. 0	. 18	6. 1–7. 3	Moderate.
GP–GM	A 1	50	45	10	>20. 0	. 02	7. 4–8. 4	Very low.
ML	A–4	100	100	95	0. 63–2. 0	. 24	7. 4–8. 4	Low.
CL	A 6	100	100	95	0. 63 2. 0	. 18	7. 4–7. 8	Moderate.
ML	A–4	100	100	85	0. 63–2. 0	. 18	7. 4–7. 8	Low.
GP–GM	A–1	50	45	5	>20. 0	. 02	7. 4–8. 4	Very low.
ML	A–4	100	100	95	0. 63–2. 0	. 20	7. 4–7. 8	Low.
GP–GM	A–1	50	45	5	>20. 0	. 02	7. 4–8. 4	Very low.
ML	A–4	100	100	95	0. 63–2. 0	. 22	7. 4–7. 8	Low.
CL	A–6	95	95	70	0. 63–2. 0	. 18	6. 1–7. 3	Moderate.
SM	A 2	95	95	25	2. 0 6. 3	. 10	6. 1 7. 3	Low.
GP–GM	A–1	50	45	10	>20. 0	. 02	7. 4–8. 4	Very low.
SM	A–4	100	100	45	2. 0–6. 3	. 16	7. 4–8. 4	Low.
SP	A–3	100	100	5	6. 3–20. 0	. 04	7. 4–8. 4	Very low.
ML	A 4	100	100	80	0. 63 2. 0	. 22	7. 4 7. 8	Low.
CL	A–4	100	100	85	0. 63–2. 0	. 18	6. 1–7. 3	Moderate.
ML	A–4	100	100	80	0. 63–2. 0	. 16	7. 4–8. 4	Low
ML	A–4	100	95	55	0. 63–2. 0	. 18	7. 4–7. 8	Low.
CL	A–6	100	100	85	0. 63–2. 0	. 18	6. 1–7. 3	Moderate.
CL	A 6	100	100	95	0. 06–0. 20	. 16	7. 4 8. 4	Moderate.

TABLE 5.—*Estimated engineering*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	Classification: Dominant USDA texture
	Feet	*In.*	
Hennepin	>5	0–60	Gravelly sandy loam
(Hennepin soils mapped only in complexes with Hochheim soils.)			
Hochheim: HmB, HmB2, HmC2, HmD2, HmE, HnA, HoC3, HoD3, HrD, HrE, HrF.	>5	0–7	Silt loam
		7–18	Clay loam
		18–60	Sandy loam
(For properties of Hennepin soil in HrD, HrE, and HrF, see the Hennepin series.)			
Houghton:			
Mucky peat: Hu	<1	0–60	Mucky peat
Peat: Hv	<1	0–60	Peat
Juneau: JuA	3 to 5	0–47	Silt loam
		47–60	Silty clay loam
Kendall: KlA	1 to 3	0–9	Silt loam
		9–42	Silty clay loam to heavy silt loam
		42–60	Loam
Keowns: Km	<1	0–8	Silt loam
		8–24	Fine sandy loam
		24–60	Silt and sand
Knowles: KwB, KwC2	>5	0–9	Silt loam
		9–25	Silty clay loam
		25–60	Dolomite
Lamartine: LmA	1 to 3	0–13	Silt loam
		13–36	Silty clay loam
		36–60	Sandy loam
Martinton: MgA	1 to 3	0–11	Silt loam
		11–23	Silty clay
		23–60	Silt and clay
Matherton: MmA	1 to 3	0–7	Silt loam
		7–17	Silty clay loam
		17–28	Clay loam
		28–60	Sand and gravel
Mayville: MoA, MoB	3 to 5	0–11	Silt loam
		11–34	Silty clay loam
		34–60	Sandy loam
Mequon: MtA	1 to 3	0–11	Silt loam
		11–26	Silty clay
		26–60	Silty clay loam
Montgomery: Mzb	<1	0–6	Silty clay loam
		6–60	Silty clay
Mundelein: MzfA	1 to 3	0–11	Silt loam
		11–26	Silt loam to silty clay loam
		26–60	Silt and fine sand
Mussey: MzkA	<1	0–9	Loam
		9–17	Sandy clay loam
		17–60	Sand and gravel
Nenno: NnA	1 to 3	0–8	Silt loam
		8–18	Clay loam
		18–60	Loam
Otter: Ot	<1	0–60	Silt loam

See footnotes at end of table.

properties of the soils—Continued

Classification—Continued		Percentage passing sieve [1] —			Permeability	Available water capacity	Reaction	Shrink-swell potential
Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)				
					In. per hr.	*In. per in.*	*pH*	
SM	A–2	75	70	30	2. 0–6. 3	0. 08	7. 4–8. 4	Low.
ML	A–4	100	100	95	0. 63–2. 0	. 20	7. 4–7. 8	Low.
CL	A–6	95	95	70	0. 63–2. 0	. 18	6. 6–7. 8	Moderate.
SC	A–4	90	80	45	0. 63–2. 0	. 10	7. 4–8. 4	Low.
Pt					2. 0–6. 3	>. 20	7. 4–7. 8	
Pt					2. 0–6. 3	>. 20	4. 5–5. 5	
ML	A–4	100	100	95	0. 63 2. 0	. 24	7. 4–7. 8	Low.
CL	A–7	100	100	95	0. 20–0. 63	. 18	7. 4–7. 8	Moderate.
ML	A–4	100	100	95	0. 63–2. 0	. 22	7. 4–7. 8	Low.
CL	A–4	100	100	100	0. 63–2. 0	. 18	6. 6–7. 3	Moderate.
ML	A–4	80	70	60	0. 63–2. 0	. 16	7. 4–8. 4	Low.
ML	A–4	100	100	95	0. 63–2. 0	. 22	7. 4–8. 4	Low.
SM	A–4	100	100	40	0. 63–2. 0	. 12	7. 4–7. 8	Low.
SM	A–4	100	100	40	0. 63–2. 0	. 16	7. 4–8. 4	Low.
ML	A–4	100	100	95	0. 63–2. 0	. 20	7. 4–7. 8	Low.
CL	A–6	100	100	85	0. 63–2. 0	. 18	7. 4–8. 4	Moderate.
					[2]		7. 4–8. 4	
ML	A–4	100	100	95	0. 63–2. 0	. 22	7. 4–7. 8	Low.
CL	A–6	100	95	90	0. 63–2. 0	. 18	6. 6–7. 3	Moderate.
SM	A–2	95	85	30	0. 63–2. 0	. 10	7. 4–8. 4	Low.
ML	A–4	100	100	95	0. 63–2. 0	. 22	7. 4–7. 8	Low.
CH	A–7	100	100	95	0. 20 0. 63	. 16	6. 6–7. 3	High.
CL	A–6	100	100	95	0. 20–0. 63	. 16	7. 4–8. 4	Moderate.
ML	A–4	100	100	85	0. 63–2. 0	. 22	7. 4–7. 8	Low.
CL	A–6	100	100	85	0. 63–2. 0	. 18	6. 6–7. 3	Moderate.
CL	A–6	95	95	70	0. 63–2. 0	. 18	6. 6–7. 3	Moderate.
GP–GM	A–1	40	35	10	>20. 0	. 02	7. 4 8. 4	Very low.
ML	A–4	100	100	95	0. 63–2. 0	. 20	7. 4–7. 8	Low.
CL	A–6	100	95	90	0. 63–2. 0	. 18	6. 1–7. 3	Moderate.
SM	A–2	95	85	35	0. 63–2. 0	. 10	7. 4–8. 4	Low.
ML	A–4	100	100	65	0. 63–2. 0	. 22	7. 4–7. 8	Low.
CH	A–7	100	100	100	0. 20–0. 63	. 16	6. 6–7. 3	High.
CL	A–6	100	100	95	0. 20–0. 63	. 18	7. 4–8. 4	Moderate.
MH	A–6	100	100	100	0. 20–0. 63	. 22	7. 4–8. 4	Moderate
CH	A–7	100	95	95	0. 20–0. 63	. 16	7. 4–7. 8	High.
ML	A–4	100	100	80	0. 63–2. 0	. 24	7. 4–7. 8	Low.
CL	A–6	100	100	85	0. 63–2. 0	. 18	6. 6–7. 3	Moderate.
ML	A–4	100	100	80	0. 63–2. 0	. 24	7. 4–8. 4	Low.
ML	A–4	95	90	55	0. 63–2. 0	. 20	7. 4–8. 4	Low.
SC	A–6	100	100	40	0. 63–2. 0	. 16	7. 4–7. 8	Moderate.
GP–GM	A–1	50	45	5	>20. 0	. 02	7. 4–8. 4	Very low.
ML	A–4	95	95	70	0. 63–2. 0	. 22	7. 4–7. 8	Low.
CL	A–6	95	95	70	0. 63–2. 0	. 18	6. 6–7. 3	Moderate.
CL	A–4	100	90	55	0. 63–2. 0	. 16	7. 4–8. 4	Low.
ML	A–4	100	100	95	0. 63–2. 0	. 22	7. 4–8. 4	Low.

TABLE 5.—*Estimated engineering*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	Classification: Dominant USDA texture
	Feet	*In.*	
Ozaukee: OuB, OuB2, OuC2, OuD2, OuE	>5	0–12	Silt loam
		12–27	Silty clay
		27–60	Silty clay loam
Palms: Pc	<1	0–28	Mucky peat
		28–60	Silt loam
Pella: Ph	<1	0–11	Silt loam
		11–32	Silty clay loam to silt loam
		32–60	Sandy loam
Radford: RaA	1 to 3	0–40	Silt loam
		40–60	Silty clay loam
Ritchey: RkB, RkC2	>5	0–8	Silt loam
		8–14	Silty clay loam
		14–60	Dolomite
Rodman	>5	0–8	Gravelly sandy loam
		8–60	Sand and gravel
(Rodman soils mapped only in complex with Casco soils.)			
St. Charles:			
Silt loam: ScA, ScB	>5	0–9	Silt loam
		9–41	Silty clay loam
		41–60	Loam
Silt loam, gravelly substratum: SeA, SeB	>5	0–13	Silt loam
		13–41	Silty clay loam
		41–50	Loam
		50–60	Sand and gravel
Saylesville: ShA, ShB	>5	0–12	Silt loam
		12–26	Silty clay
		26–60	Silty clay loam
Sebewa: Sm	>5	0–12	Silt loam
		12–26	Clay loam
		26–60	Sand and gravel
Sisson: SrB, SrC2, SrD2, SvA, SvB2, SvC2, SvD2, SvE	>5	0–14	Fine sandy loam
(For properties of Casco soil and of Hochheim soil in SvA, SvB2, SvC2, SvD2, SvE, see the Casco and Hochheim series, respectively.)		14–24	Clay loam
		24–60	Very fine sandy loam
Theresa: ThA, ThB, ThB2, ThC2	>5	0–18	Silt loam
		18–28	Clay loam
		28–60	Gravelly loam
Virgil: VsA	1 to 3	0–9	Silt loam
		9–48	Silty clay loam
		48–60	Sand and gravel
Wallkill: Wa	<1	0–22	Silt loam
		22–60	Muck and peat
Wasepi: WmA	1 to 3	0–13	Sandy loam
		13–24	Loam
		24–60	Sand
Yahara: YrA	1 to 3	0–10	Silt loam
		10–30	Fine sandy loam
		30–60	Silt and sand
Zurich: ZuA, ZuB, ZuB2, ZuC2	>5	0–18	Silt loam
		18–25	Silty clay loam
		25–60	Silt and sand

[1] The value for the percentage passing the various sieves are estimates of averages extrapolated from results of analyses such as given in table 4.

properties of the soils—Continued

Classification—Continued		Percentage passing sieve [1]—			Permeability	Available water capacity	Reaction	Shrink-swell potential
Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)				
					In. per hr.	*In. per in.*	*pH*	
ML	A–4	100	100	85	0. 63–2. 0	0. 20	7. 4–7. 8	Low.
CH	A–7	100	100	95	0. 20–0. 63	. 16	6. 1–7. 3	High.
CL	A–6	100	100	90	0. 20–0. 63	. 18	7. 4–8. 4	Moderate.
Pt					2. 0–6. 3	>. 20	7. 4–8. 4	
ML	A–4	90	85	70	0. 63–2. 0	. 18	7. 4–8. 4	Low.
ML	A–4	100	100	100	2. 0–6. 3	. 24	7. 4–8. 4	Low.
CH	A–7	100	100	95	0. 20–0. 63	. 18	7. 4–7. 8	High.
SM	A–7	100	100	45	0. 20–0. 63	. 10	7. 4–8. 4	Low.
ML	A 4	100	100	95	0. 63–2. 0	. 24	7. 4–7. 8	Low.
CL	A–6	100	100	95	0. 20–0. 63	. 18	7. 4–7. 8	Moderate.
ML	A–4	100	95	95	0. 63–2. 0	. 22	7. 4–7. 8	Low.
CL	A–4	100	100	85	0. 63–2. 0	. 18	6. 6–7. 3	Low.
					[2]		7. 4–8. 4	
SM	A–2, A–4	75	65	35	0. 63–2. 0	. 08	7. 4–8. 4	Low.
GP–GM	A–1	40	35	5	>20. 0	. 02	7. 4–8. 4	Very low.
ML	A–4	100	100	95	0. 63–2. 0	. 20	7. 4–7. 8	Low.
CL	A–6	100	100	100	0. 63–2. 0	. 18	5. 6–7. 3	Moderate.
ML	A–4	90	85	60	0. 63–2. 0	. 16	7. 4–8. 4	Low.
ML	A–4	100	100	95	0. 63–2. 0	. 20	7. 4–7. 8	Low.
CL	A–6	100	100	95	0. 63–2. 0	. 18	7. 4–7. 8	Moderate.
ML	A–4	90	85	60	0. 63–2. 0	. 16	7. 4–7. 8	Low.
GP–GM	A–1	50	45	5	>20. 0	. 02	7. 4–8. 4	Very low.
ML	A–4	100	100	100	0. 63–2. 0	. 20	7. 4–7. 8	Low.
CH	A–7	100	100	95	0. 20–0. 63	. 16	6. 1–7. 3	High.
CL	A–6	100	100	95	0. 20–0. 63	. 18	7. 4–8. 4	Moderate.
ML	A–4	100	100	95	0. 63–2. 0	. 24	7. 4–8. 4	Low.
CL	A–6	95	80	55	0. 63–2. 0	. 18	7. 4–8. 4	Moderate.
SP–SM	A–1	75	60	5	>20. 0	. 02	7. 4–8. 4	Very low.
SM	A–4	100	100	45	0. 63–2. 0	. 14	7. 4–7. 8	Low.
CL	A 7	95	95	70	0. 63–2. 0	. 18	6. 1–7. 3	Moderate.
ML	A–4	100	100	55	0. 63–2. 0	. 16	7. 4–8. 4	Low.
ML	A–4	100	100	95	0. 63–2. 0	. 20	7. 4–7. 8	Low.
CL	A–6	100	95	65	0. 63–2. 0	. 18	6. 1–7. 3	Moderate.
ML	A–4	100	90	35	0. 63–2. 0	. 16	7. 4–8. 4	Low.
ML	A–4	100	100	95	0. 63–2. 0	. 22	7. 4–7. 8	Low.
CL	A–6	100	100	95	0. 63–2. 0	. 18	6. 6–7. 3	Moderate.
GP–GM	A–1	50	45	5	>20. 0	. 02	7. 4–8. 4	Very low.
ML	A–4	100	100	95	2. 0–6. 3	. 24	6. 6–7. 3	Low.
Pt					2. 0–6. 3	>. 20	6. 6–7. 3	
SM	A–2	100	85	30	2. 0–6. 3	. 09	7. 4–7. 8	Low.
CL	A–4	100	100	55	0. 63–2. 0	. 16	6. 6–7. 3	Low.
SP–SM	A–3	100	95	5	>20. 0	. 04	7. 4–8. 4	Very low.
ML	A–4	100	100	75	0. 63–2. 0	. 18	7. 4–7. 8	Low.
SM	A–4	100	90	45	0. 63–2. 0	. 16	6. 6–7. 3	Low.
ML	A–4	100	100	65	0. 63–2. 0	. 16	7. 4–8. 4	Low.
ML	A–4	100	100	80	0. 63–2. 0	. 22	7. 4–7. 8	Low.
CL	A–6	100	100	85	0. 63–2. 0	. 18	6. 1–7. 8	High.
ML	A–4	100	100	80	0. 63 2. 0	. 16	7. 4–8. 4	Low.

[2] Variable.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—		Degree of limitations for—		
	Topsoil	Sand and gravel	Highway subgrade	Foundations for low buildings	Onsite sewage disposal
Adrian: Ak	Poor: erodible, oxidizes rapidly.	Fair: underlying sand variable and contains fines in many places; high water table hinders excavation.	Very severe: organic soils cannot be used in subgrades.	Very severe: organic soils; high water table.	Very severe: high water table.
Alluvial land: Am	Fair to good in dark, thick surface layer; poor in layer below, which has variable textures and is gravelly in places.	Unsuitable	Severe in subsoil and substratum: extremely variable; unstable at all moisture contents; very low stability when wet.	Severe: may liquefy and flow; very subject to frost heave.	Severe: periodic stream overflow; care must be taken to prevent infiltration of silt into the drainage pipe and filter beds of disposal area.
Ashkum: AtA	Good in dark, thick surface layer; poor in clayey subsoils; high water table.	Unsuitable	Very severe in subsoil and substratum: large volume change; low bearing capacity when wet; highly elastic.	Severe: fair shear strength; high compressibility; subject to shrinkage on drying; poor bearing capacity; high water table at or near the surface through most of the year.	Very severe: high water table; high shrink-swell potential; slow permeability.
Aztalan: AzA, AzB	Good in surface layer; fair to poor in lower part of subsoil; unstable on slopes.	Unsuitable	Severe: subsoil low in stability and bearing capacity when wet. Very severe in substratum: unstable at high moisture content.	Very severe: expansive when subjected to wide fluctuation in moisture content; high compressibility; poor shear strength; subject to seasonal high water table, seepage, or both.	Very severe: fluctuating water table; clayey, slowly permeable substratum.
Boyer:					
Loamy sand: BmB, BmC, BrC2, BrE2.	Unsuitable in surface layer and subsoil; subsoil erodible and thin over sand and gravel.	Fair to good: poorly graded sand and some pockets of gravel.	Slight in subsoil if properly compacted: small volume change. Slight in substratum: lacks stability under wheel loads unless moist; no volume change.	Slight: very low compressibility; no volume change on wetting and drying; good shear strength; good bearing capacity.	Slight: free draining below depth of 24 to 36 inches; periodic high water table on low terraces and areas adjacent to wetlands in places.
Sandy loam: BnA, BnB.	Poor in surface layer and in thin subsoil.	Fair to good: poorly graded sand and some pockets of gravel.	Slight in subsoil if properly compacted: small volume change. Slight in substratum: lacks stability under wheel load unless moist; no volume change.	Slight: very low compressibility; no volume change on wetting and drying; good shear strength; good bearing capacity.	Slight: free draining below depth of 24 to to 36 inches; periodic high water table on low terraces and areas adjacent to wetlands in places.

interpretations

Corrosion potential		Soil features affecting—					
		Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways
Metal	Concrete	Reservoir	Embankments				
Very high in organic soil; moderate in sand.	Very high where pH is less than 5.5; low where pH is more than 5.5.	Pervious layers; high water table; suitable for dugout ponds.	Pervious layers; organic surface layer has low stability; suitable for low embankments only; substratum has high stability but is susceptible to piping.	Moderately rapid permeability; high water table.	Rapid water-intake rate; high water-holding capacity.	Low stability; high erodibility.	High erodibility where sand is not exposed; wetness often hinders construction.
Moderate	Low	Characteristics extremely variable.	Characteristics extremely variable.	Variable texture; subject to overflow.	Characteristics extremely variable	Characteristics extremely variable.	Variable texture; wetness hinders construction at times; grassed waterways generally not required.
Very high	Low	Semipervious layers; high water table; suitable for dugout ponds.	Impervious layers; low stability; large volume change.	Moderately slow permeability; seasonal high water table.	Moderate to slow water-intake rate; high water-holding capacity; adequate drainage difficult to obtain.	Nearly level	Difficult to establish satisfactory seedbed in clayey subsoil.
High	Low	Pervious to semipervious subsoil and substratum.	Semipervious to impervious layers; subsoil has high stability and moderate volume change; substratum has low stability and large volume change.	Moderately slow permeability; subsurface drainage is beneficial.	Moderate water intake rate and water-holding capacity.	Wetness hinders construction at times.	Wetness hinders construction at times.
Low	Low	Pervious subsoil.	Pervious to semipervious layers; high stability; susceptible to piping.	Moderately rapid permeable subsoil; rapidly to very rapidly permeable substratum; present drainage is excessive.	Very rapid water intake rate; low water-holding capacity; subject to wind erosion.	Sandy profile: highly erodible.	Difficult to establish and maintain vegetative cover; slopes of 6 percent or more.
Low	Low	Pervious to semipervious subsoil.	Semipervious to impervious subsoil; high stability; small volume change.	Moderately permeable subsoil; rapid to very rapidly permeable substratum; drainage is somewhat excessive.	Rapid water intake rate; low water-holding capacity, subject to wind erosion.	Sandy profile; high erodibility.	Difficult to establish and maintain vegetative cover; slopes of 12 percent or more.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—		Degree of limitations for—		
	Topsoil	Sand and gravel	Highway subgrade	Foundations for low buildings	Onsite sewage disposal
Brookston: BsA	Good in thick, dark surface layer; fair to poor in subsoil, which is clayey in many places; high water table.	Unsuitable	Very severe in subsoil: large volume change; low bearing capacity when wet; elastic. Moderate in substratum: small volume change; fair stability when wet.	Slight: high bearing capacity; good shear strength; low compressibility; may flow if saturated during excavation; high water table.	Very severe: high water table or ponding.
Casco:					
Sandy loam: CcB2, CcC2.	Fair in thin surface layer; poor to unsuitable in clayey subsoil, which is thin over gravel.	Good: substratum has poorly graded stratified sand and gravel.	Very severe in subsoil; moderate volume change; elastic. Very slight in substratum: highly stable at any moisture content.	Slight: very low compressibility; good shear strength.	Very slight: free draining below depth of about 20 inches; periodic high water table on low terraces in places.
Loam: CeA, CeB2, CeC2, CeD2, CkC2, CrC2, CrD2, CrE. (For properties of Fox soil in mapping unit CkC2, refer to the Fox series; for properties of Rodman soils in mapping units CrC2, CrD2, and CrE, refer to the Rodman series.)	Good in thin surface layer; poor to unsuitable in clayey subsoil, which is thin over gravel.	Good: substratum has poorly graded stratified sand and gravel.	Very severe in subsoil; moderate volume change; elastic. Very slight in substratum: highly stable at any moisture content.	Slight: very low compressibility; good shear strength.	Very slight: free draining below depth of about 20 inches; periodic high water table on low terraces in places.
Colwood: Cw	Good in surface layer; fair in subsoil, which is unstable on slopes and has sand lenses; high water table.	Poor: substratum contains layers of poorly graded fine sand and a few lenses of silt and clay.	Very severe in subsoil: low bearing capacity when wet; unstable on slopes. Slight to fair in substratum if properly compacted.	Severe: when drained, may flow when saturated; fairly low compressibility; subject to frost heave and loss of bearing capacity on thawing; high water table at or near the surface most of the year.	Very severe: high water table.
Darroch: DaA	Good in surface layer; fair to poor in subsoil, which is unstable on slopes in some places; seasonal high water table.	Poor: substratum in some places contains poorly graded fine sand and silt layers; seasonal high water table.	Severe in subsoil: low bearing capacity when wet. Severe in substratum: relatively unstable at any moisture content.	Severe: may flow when saturated; fairly low compressibility; subject to frost heave and loss of bearing capacity on thawing; subject to seasonal high water table, seepage, or both.	Severe: fluctuating water table; silt and fine sand may enter tile lines.

interpretations—Continued

Corrosion potential		Soil features affecting—					
		Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways
Metal	Concrete	Reservoir	Embankments				
Very high	Low	Pervious to semipervious layers; high water table; suitable for dugout ponds.	Semipervious to impervious; subsoil has low stability and moderate volume change; substratum has high stability and small volume change.	Moderate permeability; high water table.	Moderate water intake rate; moderate to high water-holding capacity.	Nearly level	Difficult to establish satisfactory seedbed in clayey subsoil.
Low	Low	Pervious subsoil; reservoir bottom requires a seal blanket over gravelly or sandy substratum.	Semipervious layers; high stability and small volume change.	Moderate permeability; present drainage somewhat excessive.	Rapid water intake rate; low water-holding capacity, subject to soil blowing.	Sandy profile; subject to erosion.	Vegetation difficult to establish and maintain; slopes of 12 percent or more.
Low	Low	Pervious to semipervious subsoil.	Semipervious to impervious subsoil that has medium stability and moderate volume change; pervious substratum that has high stability and small volume change.	Moderate to moderately slow permeability; present drainage is adequate.	Moderate water intake rate; moderate to low water-holding capacity.	Shallow to gravelly or sandy substratum.	Areas where gravel or sand substratum is not exposed have moderate limitations; slopes of 12 percent or more.
Very high	Low	Pervious to semipervious layers; high water table; suitable for dugout ponds; sides of ponds very unstable when saturated.	Semipervious to impervious layers; low stability; susceptible to piping.	Moderate permeability; high water table.	Moderate water intake and water-holding capacity.	Low stability	High erodibility; wetness hinders construction at times.
High	Low	Pervious to semipervious layers.	Pervious to impervious layers; subsoil has medium to low stability; susceptible to piping.	Moderate permeability; seasonal high water table.	Moderate water intake rate and water-holding capacity.	Low stability; high erodibility.	High erodibility; wetness hinders construction at times.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—		Degree of limitations for—		
	Topsoil	Sand and gravel	Highway subgrade	Foundations for low buildings	Onsite sewage disposal
Dodge: DdA, DdB	Good in surface layer; poor to unsuitable in clayey subsoil.	Poor: pockets of well-graded sand and gravel in the substratum at depth of 24 to 36 inches.	Severe in subsoil: moderate volume change and loss of bearing capacity when wet. Moderate in substratum: good stability and small volume change.	Slight: low compressibility; fair shear strength; moderately good bearing capacity.	Slight: moderately permeable.
Dresden: DsA	Good in surface layer; poor in lower part of subsoil, which is gravelly and droughty in many places.	Good: substratum has poorly graded, stratified sand and gravel.	Moderate in subsoil: good bearing capacity if properly compacted. Very slight in substratum: highly stable regardless of moisture.	Slight: very low compressibility; moderate volume change on wetting; good shear strength.	Slight: free drainage below depth of about 30 inches; periodic high water table on lower terraces in places.
Drummer: Dt	Good in dark, thick surface layer; fair to poor in subsoil; high water table.	Good: substratum is poorly graded stratified sand and gravel; high water table hinders excavation.	Very severe in subsoil: moderate volume change and low stability at high moisture content. Very slight in substratum, if drained; highly stable under wheel loads.	Slight: very low compressibility; good shear strength; high water table at or near the surface most of the year.	Very severe: high water table.
Fabius: FaA	Good in thin surface layer; poor to unsuitable in clayey subsoil, which is thin over gravel; seasonal high water table.	Good: substratum is poorly graded stratified sand and gravel; seasonal high water table.	Very severe in subsoil: plastic. Very slight in substratum: highly stable at any moisture content.	Slight: very low compressibility; good shear strength; seasonal high water table, seepage, or both.	Severe: seasonal high water table.
Fox: FsA, FsB	Good in surface layer; poor in subsoil, the lower part of which is gravelly and droughty in many places.	Good: substratum has poorly graded stratified sand and gravel.	Moderate in subsoil: good bearing capacity if properly compacted. Very slight in substratum: highly stable regardless of moisture.	Slight: very low compressibility; moderate volume change on wetting; good shear strength.	Slight: free drainage below depth of about 30 inches.
Granby: GfA	Fair in dark, thin surface layer; unsuitable in droughty subsoil; high water table.	Good: substratum contains poorly graded sand; high water table hinders excavation.	Slight in subsoil: good stability and small volume change when wet. Slight in substratum: stable under wheel loads when damp; no volume change.	Slight: very low compressibility, negligible volume change on drying; good shear strength if saturated; may flow during excavation.	Very severe: high water table.

interpretations—Continued

Corrosion potential		Soil features affecting—					
		Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways
Metal	Concrete	Reservoir	Embankments				
Moderate	Low	Pervious to semipervious layers.	Semipervious to impervious layers; subsoil has medium stability and moderate volume change; substratum has high stability and small volume change.	Moderate permeability; present drainage is adequate.	Moderate water intake rate and water-holding capacity.	Most features favorable.	Most features favorable; slopes of 12 percent or more.
Low	Low	Pervious to semipervious subsoil; pervious substratum; reservoir bottom may require a seal blanket.	Semipervious to impervious subsoil that has medium stability and moderate volume change; substratum has high stability and small volume change.	Moderate permeability; present drainage is adequate.	Moderate water-intake rate and water-holding capacity.	Gravel or sand substratum hard to vegetate.	Areas where gravel or sand substratum is not exposed and only slight limitations; slopes of 12 percent or more.
High	Low	Pervious to semipervious layers; high water table; suitable for dugout ponds.	Semipervious to impervious; subsoil has medium stability and moderate volume change; substratum has high stability.	Moderate permeability; high water table; sandy substratum.	Moderate water-intake rate and water-holding capacity.	Level relief and poor drainage.	Wetness often hinders construction.
High	Low	Pervious to semipervious subsoil.	Semipervious to impervious subsoil; pervious substratum has high stability and small volume change.	Moderate permeability.	Moderate water-intake rate and water-holding capacity.	Shallow to gravelly or sandy substratum.	Areas where gravelly or sandy substratum is not exposed have moderate limitations.
Low	Low	Pervious to semipervious subsoil.	Semipervious to impervious subsoil that has medium stability and moderate volume change; substratum has high stability and small volume change.	Moderate permeability; present drainage is adequate.	Moderate water-intake rate and water-holding capacity.	Gravel or sand substratum hard to vegetate.	Areas where gravelly or sandy substratum is not exposed have only slight limitations; slopes of 12 percent or more.
Moderate	Low	Pervious subsoil; high water table.	Pervious to semipervious subsoil; substratum has medium to high stability and small volume change; susceptible to piping.	Moderately rapid permeability; high water table.	Moderate to rapid water-intake rate; low to moderate water-holding capacity.	Sandy profile; high erodibility; poor drainage.	High erodibility; wetness hinders construction at times.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—		Degree of limitations for—		
	Topsoil	Sand and gravel	Highway subgrade	Foundations for low buildings	Onsite sewage disposal
Grays: GrA, GrB	Good in surface layer; fair to poor in subsoil, which is unstable on slopes.	Poor: substratum contains poorly graded fine sand and silt layers in some places.	Severe in subsoil: moderate volume change and loss of bearing capacity when wet. Severe in substratum: relatively unstable at any moisture content.	Severe: moderate volume change; may flow when saturated; fairly low compressibility; subject to frost heave and loss of bearing capacity on thawing.	Slight: moderately to somewhat rapidly permeable.
Hebron: HeA, HeB	Good in surface layer; fair to poor in subsoil, the lower part of which is unstable on slopes.	Unsuitable: subsoil has thin layers of sand and gravel in some places.	Severe in subsoil: low stability and bearing capacity when wet. Very severe in substratum: unstable at high moisture content.	Very severe: expansive when subjected to wide fluctuation in moisture content; high compressibility; poor shear strength.	Severe: slightly fluctuating water table; generally fine-textured substratum; may require large filter bed.
Hennepin (Mapped only in complexes with Hochheim soils.)	Fair in very thin surface layer; poor in thin subsoil, which is gravelly in lower part.	Poor: substratum contains pockets of well-graded sand and gravel in some places; steep slopes.	Severe in subsoil, which is very thin if present. Moderate in substratum: small volume change and fair stability when wet.	Moderate: low compressibility; fair shear strength; good bearing capacity; steep slopes.	Slight: moderately permeable.
Hochheim: HmB, HmB2, HmC2, HmD2, HmE, HnA, HoC3, HoD3, HrD, HrE, HrF. (For properties of Hennepin soils in mapping units HrD, HrE, and HrF, refer to the Hennepin series.)	Good in surface layer in most places, but poor where severely eroded; fair to poor in clayey subsoil, which is clayey in most places.	Poor: substratum contains pockets of well-graded sand and gravel in some places.	Very severe in subsoil: moderate volume change and loss of bearing capacity when wet. Moderate to fair substratum: small volume change and fair stability when wet.	Slight: low compressibility; easy to compact; fair shear strength.	Slight: moderate permeability.
Houghton:					
Mucky peat: Hu	Poor: erodible, oxidizes rapidly.	Unsuitable	Organic soils cannot be used in subgrades.	Severe	Severe: due to high water table.
Peat: Hv	Poor: erodible, oxidizes rapidly.	Unsuitable	Organic soils cannot be used in subgrades.	Severe	Severe: due to high water table.

interpretations—Continued

Corrosion potential		Soil features affecting—					
		Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways
Metal	Concrete	Reservoir	Embankments				
Low to high.	Low.	Pervious to semi-pervious layers.	Semipervious to impervious; subsoil has low stability and moderate volume change; substratum has low stability and small volume change; susceptible to piping.	Moderate permeability; present drainage is adequate.	Moderate water-intake rate and water-holding capacity.	Low stability in substratum; wetness hinders construction at times.	Most features favorable. Slopes of 12 percent or more; moderate erodibility.
Moderate.	Low.	Pervious to semi-pervious layers.	Semipervious to impervious; low stability; medium volume change.	Slow permeability; present drainage is adequate.	Moderate water-intake rate and water-holding capacity.	Most features favorable.	Most features favorable.
Moderate.	Low.	Pervious to semi-pervious layers.	Semipervious to impervious, high stability and small volume change; some areas are stony.	Moderate permeability; occupies steep slopes; present drainage is adequate to excessive.	Moderate water-intake rate and water-holding capacity; steep slopes.	Steep slopes; stones hinder construction in places.	Slopes of 12 percent or more.
Moderate.	Low.	Pervious to semipervious subsoil.	Semipervious to impervious subsoil that has medium stability and large volume change; substratum has high stability and small volume change.	Moderate permeability; present drainage is adequate.	Moderate water-intake rate and water-holding capacity.	Stones hinder construction in places.	Stones hinder construction in places; slopes of 12 percent or more.
Very high.	Very high where pH is less than 5.5; low where pH is more than 5.5.	Pervious layers; high water table; suitable for dugout ponds; flotation of organic material may occur.	Pervious layers; low stability.	Moderately rapid permeability; high water table.	Rapid water-intake rate; very high water-holding capacity; requires drainage before irrigating.	Low stability; high erodibility.	High erodibility; wetness often hinders construction.
Very high.	Very high where pH is less than 5.5; low where pH is more than 5.5.	Pervious layers; high water table; suitable for dugout ponds; flotation of organic material may occur.	Pervious layers; low stability.	Extremely acid; drainage generally not feasible or costs prohibitive.	Small areas and extremely acid soils; irrigation generally not feasible.	Low stability; high erodibility.	Extremely acid soils; grassed waterways generally not feasible.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—		Degree of limitations for—		
	Topsoil	Sand and gravel	Highway subgrade	Foundations for low buildings	Onsite sewage disposal
Juneau: JuA	Good in thick surface layer; fair to poor in subsoil, which is clayey in places.	Poor: substratum contains pockets of sand and gravel in some places.	Very severe in subsoil: moderate volume change and low bearing capacity when wet.	Moderate: low compressibility; easy to compact; may liquefy if worked while wet; fair shear strength.	Severe: due to fluctuating water table.
Kendall: KlA	Good in surface layer; poor in moderately thick, clayey subsoil; seasonal high water table.	Poor: substratum may contain pockets of well-graded sand and gravel in some places; seasonal high water table.	Very severe in subsoil: moderate volume change and loss bearing capacity when wet; moderate in loam substratum: small volume change and fair stability when wet.	Slight: low compressibility; good bearing capacity; good to fair shear strength; may flow if saturated during excavation.	Severe: fluctuating water table.
Keowns: Km	Good in dark, thick surface layer; fair in subsoil, which is unstable on slopes; high water table.	Poor: substratum contains layers of fine poorly graded sand and silt strata in many places; high water table hinders excavation.	Severe in subsoil: relatively unstable at any moisture content. Severe in substratum: low volume change and loss of stability when wet.	Severe: moderate volume change; may flow when saturated; fairly low compressibility; subject to frost heave and loss of bearing capacity on thawing; high water table at or near the surface most of the year.	Very severe: high water table.
Knowles: KwB, KwC2	Good in surface layer; poor in subsoil, which is thin over bedrock.	Unsuitable: bedrock at depth of less than 42 inches.	Severe in subsoil: moderate volume change and low bearing capacity when wet. Very slight in substratum: in places limestone bedrock occurs.	Slight where footing rests on limestone bedrock.	Severe: less than 4 feet to orevieed limestone bedrock; unfiltered sewage may contaminate drinking water.
Lamartine: LmA	Good in surface layer; poor in clayey subsoil, which is stony in places; seasonal high water table.	Poor: substratum contains pockets of well-graded sand and gravel in some places.	Very severe in subsoil: volume change and loss of bearing capacity. Moderate in substratum: small volume change and fair stability when wet.	Slight: low compressibility; fair shear strength; moderate to good bearing capacity.	Severe: fluctuating water table.
Marsh: Mf	Unsuitable	Unsuitable	Very severe	Very severe	Very severe

interpretations—Continued

Corrosion potential		Soil features affecting—					
		Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways
Metal	Concrete	Reservoir	Embankments				
High	Low	Pervious to semipervious; bottom should be scarified and compacted.	Semipervious to impervious; medium stability and volume change.	Moderately slow permeability; present drainage is adequate.	Moderate water-intake rate and water-holding capacity.	Most features favorable.	Most features favorable.
High	Low	Pervious to semipervious layers.	Semipervious to impervious layers; medium stability; large volume change; stony in places.	Moderate permeability; subsurface and surface drainage are both beneficial.	Moderate water-intake rate; high water-holding capacity; requires drainage before irrigating.	Wetness hinders construction at times.	Wetness hinders construction at times.
High	Low	Pervious to semipervious layers; high water table.	Semipervious to impervious layers; low stability; small volume change; susceptible to piping; banks very erosive.	Moderate permeability; high water table.	Moderate water-intake rate and water-holding capacity; adequate drainage difficult to obtain.	Low stability	High erodibility; wetness hinders construction at times.
Low to moderate.	Low: bedrock may present an excavation problem.	Pervious to semipervious subsoil; reservoir bottom requires a seal blanket where limestone bedrock is exposed.	Semipervious to impervious subsoil that has medium stability and large volume change; limestone bedrock at depth of 20 to 42 inches.	Moderate permeability, present drainage is adequate.	Moderate water-intake rate and water-holdlng capacity.	Stones and bedrock hinder construction in places.	Where bedrock is not exposed limitations only slight; slopes of 12 percent of more.
High	Low	Pervious to semipervious layers.	Semipervious to impervious; subsoil has medium stability and moderate volume change; substratum has high stability and small volume change.	Moderate to moderately slow permeability; subsurface drainage beneficial.	Moderate water-intake rate and water-holding capacity.	Wetness hinders construction at times.	Wetness may hinder construction at times.
Very high	Very high where acid; low where pH is more than 5.5.	Characteristics variable.	Characteristics variable.	High water table most of the year; drainage generally not feasible or costs are prohibitive.	Irrigation generally not feasible.	Undesirable topography.	Difficult to establish and maintain vegetative cover.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of —		Degree of limitations for—		
	Topsoil	Sand and gravel	Highway subgrade	Foundations for low buildings	Onsite sewage disposal
Martinton: MgA	Good in thick, dark surface layer; fair to poor in subsoil, which is somewhat clayey and erodible on slopes.	Unsuitable: silt and clay.	Very severe in subsoil and substratum: highly elastic; large volume change; loss of bearing capacity.	Severe: expansive if moisture content fluctuates; fair shear strength; moderate compressibility.	Very severe: fluctuating water table; slow permeability.
Matherton: MmA	Good in surface layer; poor in subsoil, the lower part of which is gravelly and droughty in many places; seasonal high water table.	Good: substratum poorly graded stratified sand and gravel; seasonal high water table.	Moderate in subsoil: good bearing capacity if properly compacted. Very slight in substratum: highly stable at any moisture content.	Slight: very low compressibility; moderate volume change on wetting; good shear strength; seasonal high water table, seepage, or both.	Severe: fluctuating water table.
Mayville: MoA, MoB	Good in surface layer; poor in clayey subsoil, which is stony in places.	Poor: substratum may contain pockets of well-graded sand and gravel in some places.	Very severe in subsoil: moderate volume changes and loss of bearing capacity when wet. Moderate in substratum: good stability; small volume change.	Slight: low compressibility; fair shear strength; good bearing capacity.	Slight: moderate permeability; periodic high water table in lower areas adjacent to wetlands.
Mequon: MtA	Fair to good in thin surface layer; poor in clayey subsoil.	Unsuitable	Very severe in subsoil and substratum: large volume change; low bearing capacity when wet; elastic.	Severe: fair shear strength; moderate compressibility; subject to shrinkage on drying; poor bearing capacity; seasonal high water table, seepage, or both.	Very severe: fluctuating water table; plastic; slow permeability; clayey.
Montgomery: Mzb	Fair to good in dark surface layer; unsuitable in clayey subsoil; high water table.	Unsuitable	Severe in subsoil and substratum: large volume change; low bearing capacity; not suitable for flexible pavement.	Very severe: expansive if moisture content fluctuates; high to very high compressibility; poor shear strength; may liquefy and flow; high water table at or near the surface most of the year.	Very severe: high water table; ponding; slow permeability; plastic; clayey.
Mundelein: MzfA	Good in surface layer; fair to poor in subsoil, which is unstable on slopes in some places; seasonal high water table.	Poor: substratum contains poorly graded fine sand and silt layers in some places; seasonal high water table.	Severe in subsoil: moderate volume change and loss of bearing capacity when wet.	Severe: moderate volume change; may flow when saturated; fairly low compressibility; subject to frost heave and loss of bearing capacity on thawing; subject to seasonal high water, seepage, or both.	Severe: fluctuating water table; silt and sand may enter tile lines.

interpretations—Continued

Corrosion potential		Soil features affecting —					
		Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways
Metal	Concrete	Reservoir	Embankments				
High	Low	Semipervious layers.	Impervious layers; medium to low stability; large volume change.	Moderately slow permeability; seasonal high water table; present drainage is adequate.	Moderate to slow water-intake rate; moderate water-holding capacity.	Most features favorable.	Difficult to establish satisfactory seedbed in clayey subsoil.
Moderate	Low	Pervious to semipervious subsoil; pervious substratum; reservoir bottom should be scarified and compacted.	Semipervious to impervious subsoil that has medium stability and large volume change; pervious substratum has high stability and small volume change.	Moderate permeability; subsurface and surface drainage, or both, are beneficial.	Moderate water-intake rate and water-holding capacity; requires drainage before irrigating.	Gravel or sand substratum; hard to vegetate.	Areas where gravel or sand substratum is not exposed have only slight limitations.
Moderate	Low	Pervious to semipervious layers; reservoir bottom should be scarified and compacted.	Semipervious to impervious layers; subsoil has medium stability and moderate volume change; substratum has high stability and small volume change.	Moderate permeability; present drainage is adequate.	Moderate water-intake rate and water-holding capacity.	Most features favorable.	Most features favorable.
High	Low	Semipervious layers.	Impervious layers; low stability and large volume change.	Moderately slow permeability.	Slow water-intake rate; high water-holding capacity.	Wetness hinders construction at times.	Difficult to establish satisfactory seedbed in clayey subsoil.
Severe	Low	Semipervious layers; high water table; suitable for dugout ponds.	Impervious layers; medium to low stability; high volume change.	Moderately slow permeability; high water table.	Slow water-intake rate; high water-holding capacity.	Diversions feasible; terraces not needed; level relief and poor drainage.	Difficult to establish satisfactory seedbed in clayey subsoil.
High	Low	Pervious to semipervious layers.	Semipervious to impervious layers; subsoil has medium stability and volume change; substratum has low stability and volume change; susceptible to piping.	Moderate permeability; seasonal high water table.	Moderate water-intake rate and water-holding capacity.	Low stability; high erodibility.	High erodibility; wetness hinders construction at times.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—		Degree of limitations for—		
	Topsoil	Sand and gravel	Highway subgrade	Foundations for low buildings	Onsite sewage disposal
Mussey: MzkA	Good in dark surface layer; poor in subsoil; high water table.	Good: substratum is poorly graded sand and gravel; high water table hinders excavation.	Very severe in subsoil: low volume change and low stability at high moisture content. Very slight in substratum: if properly drained, highly stable under any moisture content.	Slight: very low compressibility; negligible volume change on wetting; good shear strength; high water table at or near the surface most of the year.	Very severe: high water table.
Nenno: NnA	Good in surface layer; fair to poor in subsoil, which is gravelly in lower part in some places; seasonal high water table.	Poor: substratum has pockets of well-graded sand and gravel in some places; seasonal high water table.	Very severe in subsoil: moderate volume change and loss of bearing capacity when wet. Moderate in substratum; small volume change and fair stability when wet.	Slight: low compressibility; fair shear strength; moderate to good bearing capacity.	Severe: fluctuating water table.
Otter: Ot	Good in thick, dark surface layer; good to fair in thick subsoil; high water table.	Unsuitable: high water table; layers of sand and gravel in some places.	Severe in subsoil and substratum: relatively unstable at any moisture content; low bearing capacity when wet.	Severe: subject to frost heave and loss of bearing capacity on thawing; may flood when wet; fair shear strength; moderate compressibility.	Very severe: high water table; silt may enter drain pipes and gravel filter beds.
Ozaukee: OuB, OuB2, OuC2, OuD2, OuE.	Good in surface layer; poor in clayey subsoil.	Unsuitable: clayey.	Severe in subsoil and substratum: large volume change and low bearing capacity when wet.	Severe: fair shear strength; moderately compressible; subject to shrinkage on drying; poor bearing capacity.	Severe: slightly fluctuating water table; fine-textured material; needs large filter field.
Palms: Pc	Poor: erodible; oxidizes rapidly.	Unsuitable	Organic soils cannot be used as subgrades.	Very severe	Very severe: high water table.
Pella: Ph	Good in surface layer; poor in subsoil, which is thin over bedrock.	Unsuitable	Very severe in subsoil and substratum: highly plastic; moderate volume change when wet; elastic.	Severe: may liquefy easily and flow; fair shear strength; moderate compressibility; high water table; may shrink if drained.	Very severe: high water table.
Radford: RaA	Good in thick surface layer; poor in thick subsoil; seasonal high water table.	Poor: seasonal high water table; substratum has pockets of sand and gravel in some places.	Very severe in subsoil: moderate volume change and low bearing capacity when wet. Poor in substratum: relatively unstable at all moisture contents.	Severe: expansive on wetting; fair shear strength; liquefies if worked while wet; subject to frost heave and seasonal high water table.	Very severe: seasonal high water table.

interpretations—Continued

Corrosion potential		Soil features affecting—					
		Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways
Metal	Concrete	Reservoir	Embankments				
Severe	Low	Pervious to semipervious subsoil; high water table; suitable for dugout ponds.	Semipervious to impervious subsoil that has medium stability and low volume change; substratum has high stability and small change.	Moderate permeability; high water table; gravelly or sandy substratum.	Moderate water-intake rate and water-holding capacity.	Shallow to gravelly or sandy substratum.	Wetness often hinders construction.
High	Low	Pervious to semipervious layers.	Semipervious to impervious layers; subsoil has medium stability and moderate volume change; substratum has high stability and small volume change.	Moderate permeability.	Moderate water-intake rate and water-holding capacity.	Wetness may hinder construction.	Wetness hinders construction at times.
High	Low	Pervious to semipervious layers; high water table; suitable for dugout ponds.	Semipervious to impervious layers; medium stability and low volume change; may be susceptible to piping.	Moderate permeability; subject to stream overflow; surface and subsurface drainage is beneficial.	Moderate water-intake rate and water-holding capacity.	Most features favorable.	Wetness hinders construction at times.
Moderate	Low	Semipervious layers.	Impervious layers; low stability and large volume change.	Moderately slow permeability; present drainage is adequate.	Moderate water-intake rate and water-holding capacity.	Most features favorable.	Difficult to establish satisfactory seedbed in clayey subsoil.
Severe	Severe where pH is less than 5.5; low where pH is more than 5.5.	Pervious layers; high water table; suitable for dugout ponds.	Pervious layers; organic material has low stability but may be used for low embankments.	Moderate permeability; high ground water table.	Rapid water-intake rate; very high water-holding capacity.	Low stability; high erodibility.	Highly erodible; wetness often hinders construction.
Severe	Low	Pervious to semipervious layers; high water table; suitable for dugout ponds.	Semipervious to impervious layers; medium stability and moderate volume change; susceptible to piping.	Moderately slow permeability; high water table.	Moderate water-intake rate; moderate to high water-holding capacity.	Most features favorable.	Wetness hinders construction at times.
Moderate	Low	Pervious to semipervious layers.	Semipervious to impervious layers; medium stability and large volume change.	Moderately slow permeability; seasonal high water table; subsurface drainage is beneficial.	Moderate water-intake rate; high water-holding capacity.	Most features favorable.	Wetness may hinder construction at times.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—		Degree of limitations for		
	Topsoil	Sand and gravel	Highway subgrade	Foundations for low buildings	Onsite sewage disposal
Ritchey: RkB, RkC2	Good in thick, dark surface layer; poor in clayey subsoil; high water table.	Unsuitable: bedrock at depth of less than 42 inches.	Severe in subsoil: low volume change and low bearing capacity when wet. Very slight in substratum: limestone bedrock occurs in places.	Slight where footing rests on limestone bedrock.	Very severe: less than 4 feet to oreviced limestone bedrock; unfiltered sewage may contaminate drinking water.
Rodman (Mapped only in complexes with Casco soils).	Unsuitable in surface layer and subsoil; soil very thin, cobbly, and droughty.	Good: substratum is poorly graded stratified sand and gravel; cobbly in places.	Very severe in subsoil and substratum: good stability; very small volume change.	Slight: good shear strength, negligible compressibility; no volume change on wetting.	Very slight: free drainage; cobblestones may interfere with installation of tile seepage bed in places.
St. Charles: Silt loam: ScA, ScB	Good in thin surface layer; poor in clayey, moderately thick subsoil.	Poor: substratum contains pockets of well-graded sand and gravel in places.	Very severe in subsoil: moderate volume change and loss of bearing capacity when wet. Moderate in loam substratum: small volume change and fair stability when wet.	Slight: low compressibility; fair shear strength; may flow if saturated during excavation.	Slight except in the more poorly drained areas.
Silt loam, gravelly substratum: SeA, SeB.	Good in surface layer; poor in clayey subsoil.	Good: substratum is poorly graded stratified sand and gravel at depth of more than 40 inches.	Severe in subsoil: moderate volume change; low bearing capacity. Very slight in substratum: highly stable under wheel loads at any moisture content.	Slight: very low compressibility; negligible volume change on wetting; good shear strength.	Slight: free drainage at a depth of 40 to 60 inches.
Saylesville: ShA, ShB	Good in surface layer; fair to poor in substratum, which is unstable on slopes in places.	Unsuitable: silt and clay.	Very severe in subsoil: large volume change; very plastic; elastic. Very severe in substratum: relatively unstable at any moisture content.	Severe: expansive if moisture content fluctuates; moderate compressibility; fair to poor shear strength; may liquefy and flow.	Severe: possibility of slightly fluctuating water table; slowly permeable substratum.
Sebewa: Sm	Good in thick, dark surface layer; fair to poor in thin subsoil; high water table.	Good: substratum is poorly graded stratified sand and gravel; high water table hinders excavation.	Very severe in subsoil: low volume change and low stability at high moisture content. Very slight in substratum: where properly drained, highly stable under wheel loads.	Slight: very low compressibility; negligible volume change on wetting; good shear strength; high water table at or near the surface most of the year.	Very severe: high water table.

interpretations—Continued

Corrosion potential		Soil features affecting—					
		Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways
Metal	Concrete	Reservoir	Embankments				
Low to moderate.	Low: bedrock may present an excavation problem.	Pervious to semipervious above bedrock.	Semipervious to impervious above bedrock; medium stability and volume change; less than 20 inches of soil over limestone bedrock.	Moderate permeability; present drainage is adequate.	Moderate water-intake rate; low water-holding capacity; shallow to limestone bedrock.	Shallow to bedrock.	Shallow to bedrock.
Low	Low	Very pervious layers; material too porous to hold water.	Very pervious layers; high stability; small volume change.	Rapid permeability below surface layer; present drainage is excessive.	Very rapid water intake rate; very low water-holding capacity; cobblestones; irregular topography.	Topography limits construction; gravelly and cobbly.	Gravelly and cobbly; very difficult to establish and vegetate.
Moderate	Low	Pervious to semipervious subsoil.	Semipervious to impervious layers; medium stability and volume change.	Moderate permeability; present drainage is adequate.	Moderate water-intake rate and water-holding capacity.	Most features favorable.	Most features favorable.
Low to moderate.	Low	Pervious to semipervious subsoil.	Semipervious to impervious subsoil that has medium stability and moderate volume change; substratum has high stability and small volume change.	Moderate permeability; present drainage is adequate.	Moderate water-intake rate and water-holding capacity.	Most features favorable.	Most features favorable; slopes of 12 percent or more.
High	Low	Semipervious layers.	Impervious layers; medium to low stability; large volume change; if present, sandy layers in substratum are susceptible to piping.	Moderately slow permeability; seasonal high water table; present drainage is adequate.	Moderate to slow water-intake rate; moderate water-holding capacity.	Most features favorable.	Difficult to establish satisfactory seedbed in clayey subsoil.
High	Low	Pervious to semipervious subsoil; high water table; suitable for dugout ponds.	Semipervious to impervious subsoil that has medium stability and moderate volume change; substratum has high stability and small volume change.	Moderate permeability; high water table; gravelly substratum.	Moderate water-intake rate and water-holding capacity.	Most features favorable.	Wetness often hinders construction.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—		Degree of limitations for—		
	Topsoil	Sand and gravel	Highway subgrade	Foundations for low buildings	Onsite sewage disposal
Sisson: SrB, SrC2, SrD2, SvA, SvB2, SvC2, SvD2, SvE. (For properties of Casco and of the Hochheim soils in mapping units SvA through SvE, refer to the Casco and Hochheim series, respectively.)	Fair in droughty surface layer; fair in subsoil, which is unstable on slopes.	Poor: substratum contains poorly graded fine sand and silt layers in places.	Severe in subsoil: moderate volume change and loss of bearing capacity when wet. Severe in substratum: relatively unstable at any moisture content.	Severe: moderate volume change; may flow when saturated; fairly low compressibility; subject to frost heave and loss of bearing capacity on thawing.	Slight: moderate to somewhat rapid permeability.
Theresa: ThA, ThB, ThB2, ThC2.	Good in surface layer; poor in subsoil, which is clayey and stony in places.	Poor: pockets of well-graded sand and gravel in the substratum in places.	Very severe in subsoil: moderate volume change and loss of bearing capacity when wet. Moderate in substratum: good stability and small volume change.	Slight: low compressibility; easy to compact; fair shear strength.	Slight: moderate permeability.
Virgil: VsA	Good in surface layer; fair to poor in surface layer, which is clayey in places; seasonal high water table.	Good: substratum is poorly graded, stratified sand and gravel at a depth of more than 40 inches; seasonal high water table.	Severe in subsoil: moderate volume change and loss of bearing capacity when wet. Very slight in substratum: highly stable at any moisture content.	Slight: very low compressibility; no volume change on wetting; good shear strength; subject to a seasonal high water table.	Severe: fluctuating water table.
Wallkill: Wa	Good in thick surface layer; poor in organic subsoil, which is erosive and oxidizes rapidly; high water table.	Unsuitable: organic material.	Organic soils cannot be used in subgrades.	Very severe: high water table; removal of organic material and special footings required.	Very severe: high water table.
Wasepi: WmA	Fair in droughty surface layer; fair in subsoil; seasonal high water table.	Good: substratum is poorly graded sand and some gravel layers.	Slight in subsoil: good stability and small volume change when wet. Slight in substratum: stable under wheel loads when moist; no volume change; may need to be confined under pavements.	Slight: very low compressibility; negligible volume change on wetting; good shear strength; may liquefy if saturated.	Severe: subject to seasonal high water table.
Wet alluvial land: Ww	Fair in surface layer; poor in subsoil, which is variable in texture and gravelly in places.	Unsuitable	Severe in subsoil and substratum: extremely variable; unstable at any moisture content; very low stability when wet.	Severe: may liquefy and flow; very subject to frost heave.	Very severe: high water table.

interpretations—Continued

Corrosion potential		Soil features affecting—					
		Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways
Metal	Concrete	Reservoir	Embankments				
Moderate to low.	Low	Pervious to semipervious layers.	Semipervious layers; low to medium stability; moderate volume change.	Moderate permeability; present drainage is adequate.	Moderate to rapid water-intake rate; moderate water-holding capacity.	Low stability; highly erodible.	Highly erodible; slopes of 12 percent or more.
Moderate		Pervious to semipervious layers.	Semipervious to impervious subsoil that has medium stability and large volume change; substratum has high stability and small volume change.	Moderate permeability; present drainage is adequate.	Moderate water-intake rate and water-holding capacity.	Stones hinder construction in places.	Stones may hinder construction; slopes of 12 percent or more.
Moderate	Low	Pervious to semipervious subsoil.	Semipervious to impervious subsoil that has medium stability and large volume change; substratum has high stability and small volume change.	Moderately slow permeability; seasonal high water table.	Moderate water-intake rate and water-holding capacity.	Wetness hinders construction at times.	Wetness hinders construction at times.
Very high in organic material.	Very high where acid; low where pH is more than 5.5.	Pervious to semipervious layers; high water table.	Pervious to impervious layers; mineral material has medium stability and large volume change; organic material has low stability.	Moderate permeability; high water table.	Moderate water-intake rate; high water-holding capacity.	Organic material has low stability and is highly erodible.	Organic material is highly erodible; wetness may hinder construction.
Moderate	Low	Pervious to semipervious subsoil; pervious substratum.	Semipervious to impervious layers; high stability and small volume change; susceptible to piping in places.	Moderately rapid permeability.	Moderate water-intake rate; moderate to low water-holding capacity.	Sandy substratum; high erodibility; wetness hinders construction at times.	Where sandy substratum is not exposed, limitations are slight; wetness may hinder construction.
High to severe.	Low	Characteristics extremely variable.	Characteristics extremely variable.	Variable texture; hazard of overflow.	Characteristics extremely variable.	Characteristics extremely variable; onsite investigation needed.	Subject to stream overflow and wetness.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—		Degree of limitations for—		
	Topsoil	Sand and gravel	Highway subgrade	Foundations for low buildings	Onsite sewage disposal
Yahara: YrA	Good in surface layer; fair in subsoil, which is unstable on slopes; seasonal high water table.	Poor: substratum contains layers of poorly graded fine sand and silt in some places.	Severe in subsoil: moderate stability and small volume change when wet if dominantly sandy material. Severe in substratum: relatively unstable at all moisture contents.	Severe: moderate volume change; may flow when saturated; fairly low compressibility; subject to frost heave and loss of bearing capacity on thawing; subject to seasonal high water table, seepage, or both.	Severe: fluctuating water table; requires onsite investigation; silt may infiltrate tile lines and filter beds.
Zurich: ZuA, ZuB, ZuB2, ZuC2.	Good in surface layer; fair to poor in subsoil, which is unstable on slopes.	Poor: substratum contains layers of poorly graded fine sand and silt in places.	Severe in subsoil: large volume change and loss of bearing capacity when wet. Severe in substratum: relatively unstable at all moisture contents.	Severe: moderate volume change; may flow when saturated; fairly low compressibility; subject to frost heave and loss of bearing capacity on thawing.	Slight: moderate to somewhat rapid permeability.

The tests that show liquid limit and plastic limit measure the effect of water on the consistence of the soil material. As the moisture content of a clayey soil increases from a very dry state, the material changes from a semisolid to a plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is in a plastic condition.

Estimated engineering properties

The soils in Washington County, their textural classification, and their estimated physical and chemical properties are given in table 5.

The information in table 5 is based on test data in table 4 and on test data from similar soils in other counties. Where test data were not available, the estimates were made by comparison with soils of like material that were tested and by study of the soils in the field.

The estimates in table 5 are only for the soils as they occur in their natural state and not for soils in areas that have been altered by cut and fill operations. The soil names are listed alphabetically. Depth to bedrock is not estimated in table 5 because that depth generally is so great that it does not affect use of the soils.

Under the heading "Classification," the USDA, Unified, and AASHO classifications are given for major soil horizons. Also shown are the estimated percentages of material passing through the various sieves. These estimates are rounded to the nearest 5 percent.

In the column showing permeability, the rate at which water moves through undisturbed soil material when it is saturated is estimated. The ratings are given in inches per hour. Permeability is determined largely by the texture, structure, and consistence of the soil. For a soil profile, the permeability rate is that of the least permeable layer.

The estimated available water capacity is given in inches per inch of soil for the major soil horizons. Available water capacity refers to the amount of water that can be stored in the soil for the use of plants. The estimates are based on the difference in the percentage of moisture retained at 1/3 and 15 atmospheres of moisture tension for medium- and fine-textured soils. For sandy soils, the estimates are based on the difference between 1/10 and 15 atmospheres of moisture tension.

The column showing reaction indicates the estimated acidity or alkalinity of a soil expressed in terms of pH. A pH of 7 indicates neutral; a pH lower than 7 indicates acidity; and a pH value higher than 7 indicates alkalinity. The pH of soil horizons can be used to indicate the need for liming, the susceptibility of metal conduits to corrosion, and of concrete conduits to deterioration.

Shrink-swell potential is an indication of the change in volume of the soil material that can be expected with changes in moisture content. It is based on volume-change tests or on observance of physical properties of the soils. It depends on the amount and kind of clay in the soil and the content of organic matter. Soils that contain mostly illite clays, for example, do not have such high shrink-swell potential as soils that contain montmorillonite clays.

interpretations—Continued

Corrosion potential		Soil features affecting—					
		Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways
Metal	Concrete	Reservoir	Embankments				
Moderate to low.	Low	Pervious to semipervious layers.	Semipervious layers; low stability; small volume change; susceptible to piping; banks very erodible.	Moderate permeability; seasonal high water table; surface drainage is beneficial.	Rapid water intake rate; moderate water-holding capacity.	Low stability; high erodibility; wetness hinders construction at times.	High erodibility; wetness hinders construction at times.
Moderate to low.	Low	Pervious to semipervious layers.	Semipervious layers; low to medium stability and moderate volume change.	Moderate permeability; present drainage is adequate.	Moderate to rapid water-intake rate; moderate water-holding capacity.	Low stability; high erodibility.	High erodibility; slopes of 12 percent or more.

Engineering interpretations

In table 6 are ratings for the suitability of the soils as a source of topsoil and of sand and gravel; the estimated degree and kind of limitations of soils used as subgrades for highways, as the base of foundations for low buildings, and for onsite sewage disposal. The corrosion potential for metal and concrete pipes is also rated in table 6, and soil features affecting engineering structures and practices are named.

Loamy land (Lu) and Sandy and gravelly land (Sf) were not included in table 6, because they are so variable that they require onsite investigations to determine suitability for most uses specified. Loamy land is unsuitable for use as topsoil and as sand and gravel, and Sandy and gravelly land is unsuitable for use as topsoil.

Topsoil is a term used to designate a fertile soil or soil material that ordinarily is rich in organic matter and that is used a a topdressing for lawns, gardens, roadbanks, and the like. The ratings indicate the suitability for such use and are *good*, *fair*, *poor*, and *unsuitable*.

The ratings for sand and gravel are based on the probability that mapped areas of the soil contain deposits of sand and gravel within a depth of 5 feet. The ratings do not indicate quality or grain size of the deposits. Individual test pits and laboratory analyses are needed for making these determinations.

Under "Degree of limitations," highway subgrade, foundations for low buildings, and onsite sewage disposal are rated slight, moderate, severe, and very severe. A rating of *slight* means that the soil has no limitation for a given use or has limitations that are easy to overcome. A rating of *moderate* means that the limitations for the given use can be overcome by good management and soil manipulation. A rating of *severe* means that the soil has limitations that are difficult to overcome. A rating of *very severe* means that the given use is generally unsound on the soil so rated.

The use of soils for highway subgrades and for bases of foundations for low buildings are mainly interpretations of soil test data for representative soils. Interpretations for wet soils are also based on the presence of a high water table (fig. 10). The surface soil generally is not used for highway subgrades, because it is relatively high in organic-matter content. The limitations of a soil used for subgrade materials are affected primarily by the bearing capacity and the shrink-swell potential of the soil. In rating limitations in table 6, slope and erosion were not considered.

In rating the limitations of a soil as a base for the foundations of low buildings, it was assumed that the foundations would be located below the depth at which the soil is subject to frost heaving, shrink-swell action, root penetration, and animal burrowing. Because the climate is cold and humid in winter in Washington County, the depth of the foundation for low buildings is determined to a great degree by the depth to which frost may cause a perceptible heave. For this reason, the substratum provides the base for building foundations and is the soil material that was evaluated for table 6.

The ratings for limitations of soils used for onsite sewage disposal indicate the capacity of the soil to absorb and dispose of sewage without contamination of sur-

Figure 10.—**A high water table caused this flooded basement and collapsing wall on a foundation constructed on Pella soils.**

rounding areas. Soils that have very severe limitations generally are not suited for the absorption of domestic sewage effluent.

Installations such as filter fields, seepage beds, and to a lesser extent, seepage pits, are considered in the evaluations. If the soil is coarse textured, deep, and of material that drains freely, a shallow pit may be satisfactory. Deep pits generally are used in soils that have slow or very slow permeability in the upper few feet but that have a rapidly permeable substratum and a low water table. How well a sewage disposal system works largely depends on the rate at which the septic tank effluent moves into and through the soil. Permeability should be moderate to rapid, and the percolation rate 1 inch per hour or more.

Among the factors that affect the limitations of soils for sewage disposal systems are structural stability, depth to the water table, depth of the soil, the nature of the underlying material, susceptibility to stream overflow, slope, and the nearness to streams and lakes. A well-developed soil structure that is stable when the soil is wet favors efficient disposal of sewage. If the structure is unstable, the soil slakes when it is wet. This slaking lessens permeability and infiltration and permits movement of soil particles into tile pipes or onto the prepared gravel bed.

A water table that rises as high as the subsurface tile forces the sewage effluent upward to the soil surface and creates an ill-smelling, unhealthful bog in the filter field. In most soils adequate filtering and purifying of septic tank effluent is provided by 4 feet of soil material between the seasonal high water table or the indurated rock and the bottom of the trench or of the filter bed.

Where the slope is more than 12 percent, filter fields generally are difficult to lay out and to construct and the seepage beds generally are impractical. Where slope is

very steep, the effluent often flows laterally and seeps out on the soil surface.

The corrosion potential of a soil for underground metal and concrete conduits is closely related to reaction, drainage, and electrical conductivity of the soil. Most conduits are laid in the lower part of the soil or in the underlying material. Corrosion potential is very high for metal conduits laid in a soil that has poor aeration, high alkalinity (high pH), high electrical conductivity, and high moisture content. Soils that have a low pH value have a high corrosion potential for concrete conduits. Both metal and concrete conduits corrode more rapidly when the moisture content of the soil is high.

Under "Soil features affecting," properties that affect specified agricultural structures and practices are listed in table 6.

Soil properties that affect the construction and maintenance of farm ponds (reservoir and embankment) are height of the water table, permeability, stoniness, depth to bedrock, strength and stability, shrink-swell potential, and organic-matter content. Figure 11 shows a recently constructed farm pond used for recreational purposes.

Some of the features that affect agricultural drainage are the rate at which water moves through the soil, the presence of restricting layers, the depth to the water table, and topography. Both surface and subsurface drainage are considered.

Soil properties affecting irrigation include depth of the soil, water-holding capacity, permeability, natural drainage, and rate of water intake. For sprinkler irrigation, slope is not so critical as it is for a gravitational system.

The suitability of a soil for terraces and diversions depends mainly on the stability, texture, and thickness of the soil material and on stoniness, rockiness, and topography. Broad-based terraces are not suitable if the slope is more than 12 percent, but diversions can be used on the steeper slopes.

The suitability of a soil for grassed waterways depends on the slope, stability, texture, and depth of the soil and on the ease with which a suitable plant cover can be established and maintained.

Descriptions of the Soils

In this section the soils of Washington County are described in detail. The approximate acreage and proportionate extent of each mapping unit are shown in table 7. Their location is shown on the soil map at the back of this survey.

The procedure in this section is first to describe a soil series, and then the mapping units in that series. Thus, to get full information on any one mapping unit, it is

Figure 11.—**Farm pond constructed on Wet alluvial land and Mequon soils.**

TABLE 7.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent	Soil	Acres	Percent
Adrian mucky peat	1, 563	0. 6	Lamartine silt loam, 1 to 3 percent slopes	4, 962	1. 8
Alluvial land	491	. 2	Loamy land	271	. 1
Ashkum silty clay loam, 0 to 3 percent slopes	836	. 3	Martinton silt loam, 1 to 3 percent slopes	2, 558	. 9
Aztalan loam, 0 to 2 percent slopes	1, 040	. 4	Marsh	651	. 2
Aztalan loam, 2 to 6 percent slopes	503	. 2	Matherton silt loam, 1 to 3 percent slopes	1, 722	. 6
Boyer loamy sand, 2 to 6 percent slopes	3, 207	1. 2	Mayville silt loam, 0 to 2 percent slopes	765	. 3
Boyer loamy sand, 6 to 12 percent slopes	238	. 1	Mayville silt loam, 2 to 6 percent slopes	7, 993	2. 9
Boyer sandy loam, 0 to 2 percent slopes	318	. 1	Mequon silt loam, 1 to 3 percent slopes	2, 106	. 8
Boyer sandy loam, 2 to 6 percent slopes	543	. 2	Montgomery silty clay loam	1, 375	. 5
Boyer complex, 6 to 12 percent slopes, eroded	1, 442	. 5	Mundelein silt loam, 1 to 3 percent slopes	2, 414	. 9
Boyer complex, 12 to 30 percent slopes, eroded	1, 215	. 4	Mussey loam, 0 to 3 percent slopes	2, 199	. 8
Brookston silt loam, 0 to 3 percent slopes	11, 239	4. 1	Nenno silt loam, 1 to 3 percent slopes	1, 947	. 7
Casco loam, 0 to 2 percent slopes	385	. 1	Otter silt loam	613	. 2
Casco loam, 2 to 6 percent slopes, eroded	3, 150	1. 1	Ozaukee silt loam, 2 to 6 percent slopes	3, 409	1. 2
Casco loam, 6 to 12 percent slopes, eroded	3, 940	1. 4	Ozaukee silt loam, 2 to 6 percent slopes, eroded	6, 057	2. 2
Casco loam, 12 to 20 percent slopes, eroded	4, 070	1. 5	Ozaukee silt loam, 6 to 12 percent slopes, eroded	1, 898	. 7
Casco sandy loam, 2 to 6 percent slopes, eroded	1, 449	. 5	Ozaukee silt loam, 12 to 20 percent slopes, eroded	381	. 1
Casco sandy loam, 6 to 12 percent slopes, eroded	867	. 3	Ozaukee silt loam, 20 to 35 percent slopes	251	. 1
Casco-Fox loams, 6 to 12 percent slopes, eroded	1, 311	. 5	Palms mucky peat	8, 764	3. 2
Casco-Rodman complex, 6 to 12 percent slopes, eroded	966	. 4	Pella silt loam	6, 935	2. 5
Casco-Rodman complex, 12 to 20 percent slopes, eroded	3, 800	1. 4	Radford silt loam, 0 to 3 percent slopes	3, 211	1. 2
Casco-Rodman complex, 20 to 35 percent slopes	10, 009	3. 7	Ritchey silt loam, 2 to 6 percent slopes	996	. 4
Colwood silt loam	4, 375	1. 6	Ritchey silt loam, 6 to 12 percent slopes, eroded	214	. 1
Darroch fine sandy loam, neutral variant, 0 to 3 percent slopes	545	. 2	St. Charles silt loam, 0 to 2 percent slopes	1, 145	. 4
Dodge silt loam, 0 to 2 percent slopes	424	. 2	St. Charles silt loam, 2 to 6 percent slopes	3, 206	1. 2
Dodge silt loam, 2 to 6 percent slopes	1, 988	. 7	St. Charles silt loam, gravelly substratum, 0 to 2 percent slopes	613	. 2
Dresden silt loam, 1 to 3 percent slopes	2, 163	. 8	St. Charles silt loam, gravelly substratum, 2 to 6 percent slopes	692	. 3
Drummer silt loam, gravelly substratum	1, 109	. 4	Sandy and gravelly land	556	. 2
Fabius loam, 1 to 3 percent slopes	1, 607	. 6	Saylesville silt loam, 0 to 2 percent slopes	670	. 2
Fox silt loam, 0 to 2 percent slopes	1, 738	. 6	Saylesville silt loam, 2 to 6 percent slopes	1, 590	. 6
Fox silt loam, 2 to 6 percent slopes	8, 941	3. 3	Sebewa silt loam	1, 530	. 6
Granby fine sandy loam, 0 to 3 percent slopes	492	. 2	Sisson fine sandy loam, 2 to 6 percent slopes	663	. 2
Grays silt loam, 0 to 2 percent slopes	273	. 1	Sisson fine sandy loam, 6 to 12 percent slopes, eroded	606	. 2
Grays silt loam, 2 to 6 percent slopes	1, 460	. 5	Sisson fine sandy loam, 12 to 20 percent slopes, eroded	410	. 1
Hebron loam, 0 to 2 percent slopes	223	. 1	Sisson-Casco-Hochheim complex, 0 to 2 percent slopes	1, 094	. 4
Hebron loam, 2 to 6 percent slopes	380	. 1	Sisson-Casco-Hochheim complex, 2 to 6 percent slopes, eroded	2, 967	1. 1
Hochheim loam, 2 to 6 percent slopes	7, 768	2. 8	Sisson-Casco-Hochheim complex, 6 to 12 percent slopes, eroded	2, 022	. 7
Hochheim loam, 2 to 6 percent slopes, eroded	8, 661	3. 2	Sisson-Casco-Hochheim complex, 12 to 20 percent slopes, eroded	1, 507	. 6
Hochheim loam, 6 to 12 percent slopes, eroded	9, 897	3. 6	Sisson-Casco-Hochheim complex, 20 to 30 percent slopes	2, 066	. 8
Hochheim loam, 12 to 20 percent slopes, eroded	8, 377	3. 1	Theresa silt loam, 0 to 2 percent slopes	1, 202	. 4
Hochheim loam, 20 to 30 percent slopes	2, 934	1. 1	Theresa silt loam, 2 to 6 percent slopes	17, 940	6. 5
Hochheim silt loam, 0 to 2 percent slopes	731	. 3	Theresa silt loam, 2 to 6 percent slopes, eroded	12, 782	4. 7
Hochheim soils, 6 to 12 percent slopes, severely eroded	389	. 1	Theresa silt loam, 6 to 12 percent slopes, eroded	3, 003	1. 1
Hochheim soils, 12 to 20 percent slopes, severely eroded	1, 056	. 4	Virgil silt loam, gravelly substratum, 0 to 3 percent slopes	291	. 1
Hochheim-Hennepin complex, 12 to 20 percent slopes	557	. 2	Wallkill silt loam	867	. 3
Hochheim-Hennepin complex, 20 to 30 percent slopes	853	. 3	Wasepi sandy loam, 1 to 3 percent slopes	602	. 2
Hochheim-Hennepin complex, 30 to 45 percent slopes	1, 031	. 4	Wet alluvial land	1, 859	. 7
Houghton mucky peat	17, 607	6. 4	Yahara silt loam, 1 to 3 percent slopes	1, 231	. 4
Houghton peat, acid variant	233	. 1	Zurich silt loam, 0 to 2 percent slopes	701	. 3
Juneau silt loam, 1 to 3 percent slopes	1, 959	. 7	Zurich silt loam, 2 to 6 percent slopes	1, 510	. 6
Kendall silt loam, 1 to 3 percent slopes	3, 824	1. 4	Zurich silt loam, 2 to 6 percent slopes, eroded	1, 383	. 5
Keowns silt loam	1, 276	. 5	Zurich silt loam, 6 to 12 percent slopes, eroded	796	. 3
Knowles silt loam, 1 to 6 percent slopes	1, 024	. 4			
Knowles silt loam, 6 to 12 percent slopes, eroded	247	. 1	Total	273, 920	100. 0

necessary to read both the description of that unit and the description of the soil series to which that unit belongs. The description of the soil series mentions features that apply to all the soils in that series. Differences among the soils of a series are pointed out in the descriptions of that soil or are indicated by the name of the soil.

A profile typical for each series is described in two ways. Many will prefer to read the short descriptions in narrative form. It is the second paragraph in the series description. The technical description of the profile is mainly for soil scientists, engineers, and others who need to make thorough and precise studies of the soils. Unless otherwise stated, the profile described is that of a dry soil. Each soil is compared with other closely related soils or soils derived from similar mineral or organic substance.

As explained in the section "How This Survey Was Made," not all mapping units are members of a soil series. Alluvial land and Marsh, for example, are land types that do not belong to any soil series. They are listed, nevertheless, in alphabetic order along with the soil series.

Following the name of each mapping unit, there is a symbol in parentheses. This symbol identifies the mapping unit on the soil map. Listed at the end of a mapping unit are the capability unit, the woodland group, the recreational group, and the wildlife group in which the mapping unit has been placed. The "Guide to Mapping Units" at the back of this survey lists the pages where each of these groups and the mapping units are described. Many terms used in the soil descriptions are defined in the Glossary and in the Soil Survey Manual (*5*).

Adrian Series

The Adrian series consists of nearly level, very poorly drained organic soils. These soils formed from decaying reeds, grasses, and sedges that are underlain by sandy soil at a depth ranging from 12 to 42 inches.

In a typical profile the surface layer is mildly alkaline, black mucky peat about 9 inches thick. The next layer, about 13 inches thick, is also mildly alkaline. In the upper part it is very dark gray mucky peat that has brown plant fibers. The lower part is very dusky red mucky peat containing dark reddish-brown plant fibers. The underlying material is pale-brown sand mottled with yellowish brown.

These soils can hold about 9 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderately rapid above the sandy underlying material, but downward movement of percolating water is prevented by a high water table.

In some artificially drained areas, these organic soils are used for corn or similar cultivated crops. Undrained areas are generally used for pasture, as woodland, or as wildlife habitat.

Typical profile of Adrian mucky peat in an undisturbed area (SW¼SW¼ sec. 23, T. 12 N., R. 20 E.):

1—0 to 9 inches, black (10YR 2/1) mucky peat; moderate, medium, granular structure; very friable, few bleached grains of quartz sand; mildly alkaline; gradual, smooth boundary.

2—9 to 13 inches, very dark gray (5YR 3/1) mucky peat; weak, medium, subangular blocky structure; friable; common, fine, brown (7.5YR 4/4) plant fibers; mildly alkaline; gradual, smooth boundary.

3—13 to 22 inches, very dusky red (2.5YR 2/2) mucky peat; moderate, medium, subangular blocky structure; friable; few, fine, dark reddish-brown (5YR 3/3) plant fibers; mildly alkaline; abrupt, smooth boundary.

IIC—22 to 60 inches +, pale-brown (10YR 6/3) sand; single grain; loose; few, fine, distinct mottles of yellowish brown (10YR 5/6); calcareous.

In some places Adrian soils contain a few, small, woody fragments and some less decomposed fibrous materials. The IIC horizon is gravelly in some places.

Adrian soils have a coarser textured substratum than Palms soils, which are underlain by loamy materials. In contrast to Adrian soils, Houghton soils formed in organic deposits that are more than 42 inches thick.

Adrian mucky peat (0 to 2 percent slopes) (Ak).—This organic soil of the lowlands is frequently flooded along streams and around lakes. It is suited to cultivated crops if it is drained and properly managed, but use for cultivated crops in undrained areas is very severely limited. (Capability unit IVw–1; woodland group 10; recreation group 1; wildlife group 2)

Alluvial Land

Alluvial land (0 to 2 percent slopes) (Am) consists of loamy soil material and is moderately well drained to well drained. It is in an irregular pattern on stream flood plains that are cut by present streams and older stream channels.

Soils in areas of Alluvial land have variable profile characteristics. The surface layer ranges from sandy loam to silt loam and, in many places, is underlain by stratified sandy and loamy materials.

Alluvial land is subject to occasional flooding and generally is not used for crops. It is suited to pasture, trees, or plants that provide food and cover for wildlife, such as upland game, migratory waterfowl, and furbearers. (Capability unit IIw–4; woodland group 1; recreation group 4; wildlife group 5)

Ashkum Series

The Ashkum series consists of nearly level or gently sloping, poorly drained soils that occur on lowlands. These soils are underlain by calcareous silty clay loam glacial till.

In a typical profile the surface layer is mildly alkaline, very dark gray silty clay loam about 9 inches thick. The subsoil is about 17 inches thick. In the upper part it is mildly alkaline, dark grayish-brown silty clay that contains light olive-brown mottles. The lower part is calcareous, grayish-brown silty clay loam containing light olive-brown mottles. The underlying till is brown silty clay loam that is calcareous and contains mottles of yellowish brown.

Between the surface and a 5-foot depth, these soils can hold about 11 inches of water available to plants. Permeability is moderately slow, internal drainage is very slow, and natural fertility is moderate.

After these soils are adequately drained, they can be used for corn, small grains, legumes, and other common crops. Most undrained soils are in pasture or woodland.

Typical profile of Ashkum silty clay loam, 0 to 3 percent slopes, in a cultivated field (SW¼SW¼ sec. 27, T. 9 N., R. 20 E.):

Ap—0 to 9 inches, very dark gray (10YR 3/1) silty clay loam; moderate, medium, granular structure; friable; mildly alkaline; abrupt, smooth boundary.

B2g—9 to 22 inches, dark grayish-brown (2.5Y 4/2) silty clay; few, fine, distinct mottles of light olive brown (2.5Y 5/6); moderate, medium, angular blocky structure; firm; mildly alkaline; clear, smooth boundary.

B3g—22 to 26 inches, grayish-brown (2.5Y 5/2) silty clay loam; common, medium, distinct mottles of light olive brown (2.5Y 5/6); moderate, medium, subangular blocky structure; firm; calcareous; clear, smooth boundary.

C—26 to 36 inches +, brown (10YR 5/3) silty clay loam; many, medium, distinct mottles of yellowish brown (10YR 5/6); massive; firm; calcareous.

The Ap or A1 horizon is very dark gray (10YR 3/1) or black (10YR 2/1) in color and from 8 to 12 inches in thickness. The solum ranges from 24 to 30 inches in thickness. In places the upper part of the profile is loess as much as 12 inches thick.

The Ashkum soils have a finer textured substratum than the Brookston soils, which have 10 to 30 inches of silty soil over loam to sandy loam till. The Montgomery soils formed in lake-laid silt and clay.

Ashkum silty clay loam, 0 to 3 percent slopes (AtA).—This soil of the lowlands is subject to periodic flooding, has a high water table at times, and, where it is sloping, is slightly susceptible to erosion. Nevertheless, if the soil is drained and properly managed, it is well suited to crops commonly grown in the county. The use of undrained areas for cultivated crops is severely limited. (Capability unit IIw–1; woodland group 7; recreation group 3; wildlife group 2)

Aztalan Series

The Aztalan series consists of nearly level, somewhat poorly drained soils that formed in calcareous stratified loamy outwash underlain by lacustrine silty clay loam.

In a typical profile the surface layer, to a depth of about 8 inches, is mildly alkaline, black loam. Just below is 3 inches of mildly alkaline, very dark grayish-brown loam that has black coatings of organic matter on the soil aggregates, or peds.

The subsoil is about 17 inches thick. The upper part is mildly alkaline, brown sandy clay loam. The middle part is mildly alkaline, brown, gritty silty clay loam. The lower part is calcareous, brown silty clay. The subsoil is mottled throughout with light brownish gray and yellowish brown.

The underlying material is calcareous, light yellowish-brown silty clay loam mottled with light brownish gray and yellowish brown.

These soils can hold about 11 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderately slow, internal drainage is slow, and the water table is seasonally high. Natural fertility is high.

After these soils are adequately drained, they can be used for corn, small grains, legumes, and other common crops. Most undrained areas are in pasture or are woodland.

Typical profile or Aztalan loam, 0 to 2 percent slopes, in a cultivated field (NE¼NW¼ sec. 15, T. 11 N., R. 20 E.):

Ap—0 to 8 inches, black (10YR 2/1) loam; weak, medium, subangular blocky to moderate, medium, granular structure; friable; mildly alkaline; abrupt, smooth boundary.

A3—8 to 11 inches, very dark grayish-brown (10YR 3/2) loam; weak, coarse, prismatic to weak, thick, platy structure; friable; black (10YR 2/1) coatings of organic matter on vertical ped faces; mildly alkaline; clear, wavy boundary.

B1g—11 to 16 inches, brown (10YR 5/3) sandy clay loam; few, medium, faint mottles of light brownish gray (10YR 6/2) and many, medium, distinct mottles of yellowish brown (10YR 5/6 and 10YR 5/8); weak, coarse, prismatic to moderate, medium, subangular blocky structure; firm; mildly alkaline; clear, wavy boundary.

I-IIBtg—16 to 22 inches, brown (10YR 5/3) gritty silty clay loam; many, medium, faint mottles of light brownish gray (10YR 6/2) and distinct mottles of yellowish brown (10YR 5/6 and 10YR 5/8); weak, coarse, prismatic to moderate, fine, angular blocky structure; firm; light-gray (10YR 7/1) lime coatings and clay films on some ped faces; mildly alkaline; clear, wavy boundary.

IIB3—22 to 28 inches, brown (10YR 5/3) silty clay; many, medium, distinct mottles of yellowish brown (10YR 5/6) and light brownish gray (2.5Y 6/2); weak, medium, prismatic to moderate, fine and medium, angular blocky structure; firm; calcareous; gradual, irregular boundary.

IIC—28 to 60 inches +, light yellowish-brown (10YR 6/4) silty clay loam; many, medium, distinct mottles of yellowish brown (10YR 5/6) and light brownish gray (2.5Y 6/2); weak, thick, platy to weak, fine, angular blocky structure; slightly firm; lime streaks in vertical cracks; calcareous.

The Ap horizon is loam or silt loam. It is generally black (10YR 2/1) but in places is very dark grayish brown (10YR 3/2). Thickness of the solum ranges from 24 to 36 inches. The underlying lacustrine sediments are generally silty clay loam that has thin layers of fine sand in places.

Aztalan soils are finer textured in the substratum than Matherton soils, which are loamy and are underlain by stratified sand and gravel. In contrast to the Aztalan soils, the Martinton soils formed entirely in lacustrine silt and clay and lack the overlying coarser textured material.

Aztalan loam, 0 to 2 percent slopes (AzA).—This soil has a seasonal high water table. Its profile is the one described as typical for the series. Included in mapping are some areas that have a silt loam surface layer.

If this soil is drained and properly managed, it is well suited to the crops commonly grown in the county. Undrained areas, however, have severe limitations if used for cultivated crops. (Capability unit IIw–2; woodland group 7; recreation group 4; wildlife group 2)

Aztalan loam, 2 to 6 percent slopes (AzB).—This soil has a somewhat thinner surface layer and subsoil than described as typical for the series. The hazard of erosion is slight, and there is a seasonal high water table.

If drained and well managed, this soil is well suited to crops commonly grown in the county. In undrained areas, water moves laterally in the subsoil, and use for cultivated crops is limited. (Capability unit IIw–2; woodland group 7; recreation group 4; wildlife group 2)

Boyer Series

The Boyer series consists of nearly level to steep, well-drained soils that are 24 to 40 inches deep over sand and gravel outwash.

In a typical profile the surface layer, to a depth of about 4 inches, is strongly acid, very dark brown to very

dark gray and dark grayish-brown loamy sand. Just below is strongly acid to slightly acid, yellowish-brown loamy sand that extends to a depth of about 17 inches.

The subsoil is about 8 inches thick. In the upper part it is slightly acid, yellowish-red heavy sandy loam. The lower part of the subsoil is slightly acid, reddish-brown sandy clay loam.

The substratum is glacial outwash consisting of calcareous, light yellowish-brown sand and gravel.

These soils can hold about 4 inches of water available to plants between the surface and a depth of 5 feet. Permeability of the surface layer and subsoil is moderately rapid, internal drainage is rapid, and natural fertility is low.

In areas where the Boyer soils are nearly level to sloping, they are used mostly for corn, small grains, legumes, and other crops commonly grown in the county. Where the soils are steeper, they are generally in pasture or woodland.

Typical profile of Boyer loamy sand, 2 to 6 percent slopes, in an undisturbed area (NE¼SE¼ sec. 24, T. 11 N., R. 19 E.):

A1—0 to 2 inches, very dark brown (10YR 2/2) to very dark gray (10YR 3/1) loamy sand; weak, very fine, granular structure; very friable; strongly acid; clear, wavy boundary.

A21—2 to 4 inches, dark grayish-brown (10YR 4/2) loamy sand; weak, very fine, granular structure; very friable; strongly acid; clear, wavy boundary.

A22—4 to 11 inches, yellowish-brown (10YR 5/4) loamy sand; weak, very fine, granular structure; very friable; strongly acid; diffuse, wavy boundary.

A3—11 to 17 inches, yellowish-brown (10YR 5/4) loamy sand; weak, very fine, granular structure; very friable; slightly acid; abrupt, wavy boundary.

B21t—17 to 21 inches, yellowish-red (5YR 4/6) heavy sandy loam; moderate, fine, subangular blocky structure; friable; clay bridges between sand grains; slightly acid; gradual, wavy boundary.

B22t—21 to 25 inches, reddish-brown (5YR 4/4) sandy clay loam; moderate, fine, subangular blocky structure; friable; thin, patchy clay films on ped faces; slightly acid; abrupt, wavy boundary.

C—25 to 60 inches +, light yellowish-brown (10YR 6/4) gravel and sand; single grain; loose; calcareous.

The A horizon is loamy sand or sandy loam. The Ap horizon is generally dark grayish brown (10YR 4/2). In thickness the Ap horizon ranges from 6 to 9 inches. Undisturbed areas generally have an A1 horizon less than 4 inches thick. The texture of the B2 horizon ranges from sandy loam to sandy clay loam. In the C horizon the sand is fine to medium.

The Boyer soils have a coarser textured solum than the Fox soils.

Boyer loamy sand, 2 to 6 percent slopes (BmB).—This soil has the profile described as typical for the series. Where the surface is left unprotected, soil blowing and water erosion are likely to thin the surface layer and reduce fertility, and use for intensive cultivation is thereby severely limited. (Capability unit IIIs–1; woodland group 3; recreation group 5; wildlife group 4)

Boyer loamy sand, 6 to 12 percent slopes (BmC).—This soil occurs on uplands and is rolling in some areas. The combined thickness of its surface layer and subsoil is about 3 inches less than that described as typical for the series.

This soil is droughty and is susceptible to damage by soil blowing and water erosion. Consequently, use for intensive cropping is severely limited. Unless the surface is protected, erosion thins the surface layer and lowers fertility. (Capability unit IIIe–2; woodland group 3; recreation group 5; wildlife group 4)

Boyer sandy loam, 0 to 2 percent slopes (BnA).—In the profile of this soil sand and gravel is at a depth of about 6 inches more than in the profile described as typical for the series. Included in mapping are small areas of soils that have a very dark grayish-brown surface layer and soils that are moderately well drained instead of well drained.

This soil is droughty and severely limited if used for intensive cropping. Unless the soil is protected, soil blowing and water erosion are likely to thin the surface layer and reduce fertility. (Capability unit IIIs–1; woodland group 3; recreation group 6; wildlife group 4)

Boyer sandy loam, 2 to 6 percent slopes (BnB).—This well-drained soil occupies uplands. Included with it in mapping are small areas of a soil that is only moderately well drained, small areas of Fox sandy loam, and soils that have a very dark grayish-brown surface layer.

Boyer sandy loam, 2 to 6 percent slopes, is droughty and severely limited if used for intensive cultivation. Keeping the surface protected controls soil blowing and water erosion and helps to maintain fertility. (Capability unit IIIs–1; woodland group 5; recreation group 6; wildlife group 4)

Boyer complex, 6 to 12 percent slopes, eroded (BrC2).—This complex consists of Boyer soils that occur in such an intricate pattern that mapping the soils separately is impractical. Slopes are rolling in many areas.

About 60 percent of the acreage is Boyer loamy sand, and 40 percent is Boyer sandy loam. These soils have a thinner, lighter colored surface layer than that described as typical for the series. Included in areas mapped as this complex are small areas in which a loamy sand surface layer is underlain by fine or medium sand. Also included are small areas where soil blowing is severe and wooded areas where erosion is only slight.

These soils of the uplands are highly susceptible to soil blowing, and their use for intensive cultivation is severely limited. In addition, plant growth is limited by droughtiness. If the soils are left unprotected, soil blowing and water erosion are likely to thin the surface layer and reduce fertility. (Capability unit IIIe–2; woodland group 4; recreation group 5; wildlife group 4)

Boyer complex, 12 to 30 percent slopes, eroded (BrE2).—This mapping unit is about 60 percent Boyer sandy loam and about 40 percent Boyer loamy sand. Both soils have a thinner, lighter colored surface layer than that described as typical for the series.

Included in mapping are small areas where a loamy sand surface layer overlies fine or medium sand. Also included are wooded areas in which erosion is only slight. In addition, small inclusions are severely eroded and are marked by blowouts and gullies.

These soils of the uplands are suitable as woodland or for wildlife or recreation. Droughtiness limits plant growth, and erosion is a severe hazard in unprotected areas. (Capability unit VIe–1; woodland group 4; recreation group 5; wildlife group 4)

Brookston Series

The Brookston series consists of nearly level to gently sloping, poorly drained soils. These soils of the lowlands formed in a mantle of loess less than 20 inches thick over calcareous glacial till.

In a typical profile the surface layer is mildly alkaline silt loam about 13 inches thick. It is black to a depth of 11 inches and very dark gray below. The subsoil is mildly alkaline and about 27 inches thick. In the upper part it is olive-gray clay loam mottled with strong brown. The lower part is light olive-gray gravelly loam mottled with stong brown. The substratum is dark-gray loam.

These soils can hold about 9 inches of water available to plants between the surface and a depth of 5 feet. A high water table prevents downward movement of water. Permeability is moderate, internal drainage is very slow, and natural fertility is high. Crops respond well if a complete fertilizer is added.

After these soils are adequately drained, they can be used for small grains and other crops commonly grown in the county. Most undrained areas are wooded or pastured.

Typical profile of Brookston silt loam, 0 to 3 percent slopes, in a cultivated field (NW¼NW¼ sec. 22, T. 11 N., R. 18 E.):

Ap—0 to 11 inches, black (10YR 2/1) silt loam; moderate, medium, granular structure; very friable; mildly alkaline; clear, smooth boundary.

A3g—11 to 13 inches, very dark gray (10YR 3/1) silt loam; moderate, fine, blocky structure; friable; mildly alkaline; clear, smooth boundary.

IIB2tg—13 to 28 inches, olive-gray (5Y 5/2) clay loam; many, medium, distinct mottles of strong brown (7.5YR 5/6); moderate, medium, angular blocky structure; thin, patchy clay films; firm; mildly alkaline; clear, wavy boundary.

IIB3g—28 to 40 inches, olive-gray (5Y 5/2) gravelly loam; many, medium, distinct mottles of strong brown (7.5YR 5/6); weak, medium, subangular blocky structure; firm; mildly alkaline; clear, wavy boundary.

IIC—40 to 60 inches +, dark-gray (5Y 4/1) loam; few, medium, distinct mottles of strong-brown (7.5YR 5/6); massive; firm, calcareous.

The Ap horizon is generally black (10YR 2/1), but it is very dark gray (10YR 3/1) in places. It ranges from 9 to 12 inches in thickness. The solum is 36 to 48 inches thick. The B2g horizon ranges from clay loam to silty clay loam. The C horizon ranges from sandy loam to loam in texture and contains lenses of sand and gravel in places.

The Brookston soils have more stones and pebbles in the lower part of the profile than the Colwood soils, which are underlain by lacustrine silt and fine sand. In contrast to the Brookston soils, the Pella soils have more than 36 inches of silty soil over the till.

Brookston silt loam, 0 to 3 percent slopes (BsA).—This soil has the profile described as typical for the series. The water table is seasonally high, and flooding is periodical. The erosion hazard is slight in the more sloping areas. In some areas stones and cobblestones are common on the surface. Included in mapping are areas that have slopes of more than 3 percent. These inclusions are along foot slopes and are wet by water that seeps from upland areas.

Undrained areas of this soil have severe limitations if used for cultivated crops. (Capability unit IIw–1; woodland group 7; recreation group 3; wildlife group 2)

Casco Series

The Casco series consists of nearly level to steep, well-drained soils that formed in stratified sand and gravel. In many places these soils are mantled with silt as much as 18 inches thick (fig. 12).

In a typical profile the surface layer is mildly alkaline, dark grayish-brown loam about 7 inches thick.

The subsoil is about 10 inches thick. The upper part is mildly alkaline, brown loam to clay loam that has thin clay films on the soil aggregates, or peds. The lower part is mildly alkaline, dark reddish-brown sandy clay loam that has thick clay films on the peds.

The substratum is calcareous, light-brown outwash sand and gravel.

These soils can hold about 4 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, internal drainage is rapid, and natural fertility is low to moderate.

Where the Casco soils are nearly level to sloping, they are mostly used for corn, small grains, legumes, and other crops commonly grown in the county. In steeper areas, they generally are in pasture or are wooded.

Typical profile of Casco loam, 2 to 6 percent slopes, eroded, in a cultivated field (NE¼SE¼ sec. 18, T. 11 N., R. 20 E.):

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) loam; weak, fine, granular structure; friable; mildly alkaline; clear, wavy boundary.

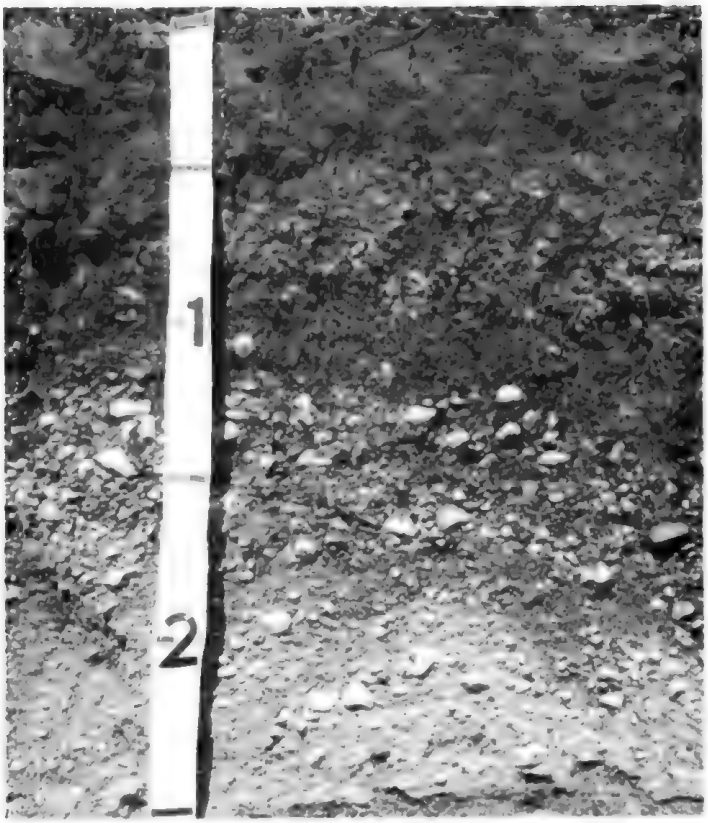

Figure 12.—Casco loam showing loose, calcareous sand and gravel at a depth of about 17 inches.

B1—7 to 10 inches, brown (7.5YR 4/4) clay loam; moderate, medium, subangular blocky structure; friable; few pebbles; thin, patchy clay films on ped faces; mildly alkaline; clear, wavy boundary.

B2t—10 to 17 inches, dark reddish-brown (5YR 3/3) sandy clay loam; weak, fine, subangular blocky structure; friable; many pebbles as much as 2 inches in diameter; thick, continuous clay films on the peds; mildly alkaline; wavy boundary.

C1—17 to 25 inches, brown (7.5YR 4/4) gravel and sand; single grain; loose; slightly calcareous; gradual, wavy boundary.

C2—25 to 60 inches +, light-brown (7.5YR 6/4) gravel and sand; single grain; loose; calcareous.

The Ap horizon is silt loam, loam, or sandy loam. It generally is dark grayish brown (10YR 4/2). It ranges from 6 to 9 inches in thickness. In undisturbed areas the A1 horizon generally is very dark gray (10YR 3/1) and is less than 4 inches thick. The solum ranges from 14 to 20 inches in thickness. The B2 horizon ranges from sandy clay loam to clay loam, and the C horizon ranges from sandy to cobbly.

Casco soils are more shallow than Fox soils, which formed in 20 to 40 inches of silty material over sand and gravel. Casco soils also are underlain by sand and gravel, but Hochheim soils are underlain by loamy till.

Casco loam, 0 to 2 percent slopes (CeA).—In most places the combined thickness of the surface layer and the subsoil is about 2 inches more than that of the profile described as typical for the series. Included in mapping are some areas that have a silt loam surface layer and other areas that have a very dark grayish-brown surface layer.

This soil of the uplands has few limitations to intensive cropping. Droughtiness is a limitation, but with good management this soil generally is suited to the crops commonly grown in the county. (Capability unit IIIs–1; woodland group 5; recreation group 9; wildlife group 4)

Casco loam, 2 to 6 percent slopes, eroded (CeB2).—This soil is somewhat droughty. It has the profile described as typical for the series. Included in mapping are some areas that have undulating, complex slopes. Where these areas are in permanent pasture or woodland, they are only slightly eroded on the lower parts of the slopes.

This soil of the uplands is susceptible to further erosion, and it has moderately severe limitations if cultivated intensely. Unless this soil is protected, erosion thins the surface layer and lowers fertility. (Capability unit IIIe–2; woodland group 5; recreation group 9; wildlife group 4)

Casco loam, 6 to 12 percent slopes, eroded (CeC2).—This soil is somewhat droughty. The surface layer is lighter colored than that in the profile described as typical for the series, and thickness of the combined surface layer and subsoil is about 14 inches, or 3 inches thinner. In some areas this soil is rolling and has complex slopes. Cobblestones and pebbles are exposed in places. Included in mapping are areas in permanent pasture and wooded areas that are only slightly eroded, but erosion is severe on some of the steeper slopes.

This soil of the uplands is susceptible to further erosion. It has severe limitations if used for intensive cultivation. In unprotected areas, erosion thins the surface layer and reduces fertility. Good management helps to control erosion and to maintain the content of organic matter. (Capability unit IVe–2; woodland group 5; recreation group 9; wildlife group 4)

Casco loam, 12 to 20 percent slopes, eroded (CeD2).—The surface layer of this soil is lighter colored than in the profile described as typical for the series, and the combined surface layer and subsoil is about 4 inches thinner. In some areas this soil grades toward Rodman soils, and in other areas it grades toward Fox soils. Some areas are hilly. In places cobblestones and pebbles are exposed at the surface. Included in mapping are severely eroded areas and, in woodland and permanent pasture, areas that are only slightly eroded. Also included are soils that have a silt loam suface layer.

This soil of the uplands is suitable for pasture, trees, wildlife, or recreation areas. (Capability unit VIe–2; woodland group 5; recreation group 9; wildlife group 4)

Casco sandy loam, 2 to 6 percent slopes, eroded (CcB2).—This soil has a lighter colored, coarser textured surface layer than that in the soil in the profile described as typical for the series. Erosion has thinned the surface layer and reduced fertility. Some areas are undulating and have complex slopes. Included with this soil in mapping, in woodland, permanent pasture, and less sloping areas, are soils that are only slightly eroded.

Because this soil of the uplands is susceptible to further erosion, it has moderately severe limitations if cropped intensively. Droughtiness and lack of organic matter are limitations to use, and management is needed to add organic matter. Management is also needed to control erosion. (Capability unit IIIe–2; woodland group 5; recreation group 6; wildlife group 4)

Casco sandy loam, 6 to 12 percent slopes, eroded (CcC2).—This soil is fairly droughty and in places has sand and gravel exposed at the surface. It has a lighter colored, coarser textured surface layer than that in the profile described as typical for the series and a thinner combined surface layer and subsoil. In some places this soil is rolling and has complex slopes. Included with this soil in mapping, in woodland and permanent pasture, are areas that are only slightly eroded. In the more eroded areas the surface layer has been thinned and fertility is reduced.

Because this soil of the uplands is susceptible to further erosion, it has severe limitations to cropping. (Capability unit IVe–2; woodland group 5; recreation group 6; wildlife group 4)

Casco-Fox loams, 6 to 12 percent slopes, eroded (CkC2).—In many places these soils are rolling. Erosion has thinned the surface layer and reduced fertility. Included with these soils in mapping are some severely eroded areas.

This mapping unit is about 60 percent Casco soils and about 40 percent Fox soils. In the Casco soils thickness of the combined surface layer and subsoil is 15 inches, or about 2 inches thinner than that in the profile described as typical for the Casco series. Casco soils are fairly droughty and in places have cobblestones and pebbles exposed at the surface. Included in mapping are areas of Casco soils that have a silt loam surface layer.

The Fox soils have a coarser textured surface layer than that in the profile described as typical for the Fox series. Also, its combined surface layer and subsoil is about an inch thinner than in the typical profile.

Because these soils of the uplands are susceptible to further erosion, they have moderately severe limitations

if cropped intensively. (Capability unit IVe–2; woodland group 1; recreation group 9; wildlife group 4)

Casco-Rodman complex, 6 to 12 percent slopes, eroded (CrC2).—Many areas of the soils in this complex have cobblestones and pebbles exposed at the surface. In unprotected areas, erosion has thinned the surface layer and reduced fertility. Included with this complex in mapping are some severely eroded areas and, in permanent pasture and woodland, areas that are only slightly eroded.

This complex is about 65 percent Casco soils and about 35 percent Rodman soils. The Casco soils have a thinner, lighter colored surface layer than in the profile described as typical for the series, and thickness of the combined surface layer and subsoil is about 14 inches, or thinner than typical. The surface layer is generally loam, but it is sandy loam in some places.

The Rodman soils have a gravelly sandy loam surface layer, which is coarser textured than that described as typical. Also, the combined surface layer and subsoil is thinner and lighter colored. In most places the Rodman soils are on the steeper convex slopes.

Because these droughty soils of the uplands are subject to erosion, use for crops is limited. The low water holding capacity of the Rodman soils further limits the growth of crops. (Capability unit IVe–2; woodland group 5; recreation group 5; wildlife group 4)

Casco-Rodman complex, 12 to 20 percent slopes, eroded (CrD2).—The soils in this complex have pebbles and cobblestones on the surface in many places. Included with these soils in mapping are severely eroded areas and, in woodland and permanent pasture, areas that are only slightly eroded.

This complex is about 60 percent Casco soils and about 40 percent Rodman soils. The surface layer of Casco soils is generally loam, but it is gravelly sandy loam in many places. The combined surface layer and subsoil, about 13 inches thick, is thinner and lighter colored than in the profile described as typical for the Casco series.

The Rodman soils have a gravelly sandy loam surface layer in most places, but it is thinner and lighter colored than in the profile described as typical for the Rodman series. Rodman soils are hilly in many places and generally are on the steep convex slopes.

The soils in this complex are suitable for pasture, as woodland, and as wildlife and recreation areas. Droughtiness extremely limits plant growth. (Capability unit VIe–2; woodland group 5; recreation group 5; wildlife group 4)

Casco-Rodman complex, 20 to 35 percent slopes (CrE).—This complex has pebbles and cobblestones exposed at the surface in many areas. It contains about 60 percent Casco soils and 40 percent Rodman soils. The Casco soils have a thinner, lighter colored surface layer than that in the profile described as typical for the Casco series, and a thinner combined surface layer and subsoil. The Casco soils grade into the Rodman soils. The Rodman soils have a thinner, lighter colored surface layer than in the profile described as typical for the Rodman series. The Rodman soils generally are on the convex slopes. Included in this complex in mapping are areas that have slopes of more than 35 percent. Also included are severely eroded, deeply gullied areas (fig. 13).

The soils in this complex are better suited as woodland, wildlife habitat, and recreation areas than as cropland or

Figure 13.—**Gully threatening a home foundation after a heavy rainstorm. These steep soils are in the Casco-Rodman complex, 20 to 35 percent slopes.**

pasture. Plant growth is limited by extreme droughtiness. These soils need careful management that helps to control erosion by restoring and maintaining the vegetative cover. (Capability unit VIIe–1; woodland group 5; recreation group 5; wildlife group 4)

Colwood Series

The Colwood series consists of nearly level soils that formed from calcareous lake-laid silt and fine sand. These soils of the lowlands are poorly drained.

In a typical profile the surface layer is neutral, black silt loam about 8 inches thick. Just below is about 2 inches of neutral, very dark gray silt loam.

The subsoil is about 18 inches thick. It is neutral, grayish-brown loam in the upper part, mildly alkaline, olive-gray silt loam in the middle, and weakly calcareous, light brownish-gray silt loam in the lower part.

The substratum is calcareous, light yellowish-brown stratified silt and fine sand mottled with light gray and yellowish brown.

These soils can hold about 12 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, internal drainage is medium, and natural fertility is high.

After these soils are adequately drained, they can be used for corn, small grains, legumes, and other common crops. Most undrained areas are pastured or wooded.

Typical profile of Colwood silt loam, in a cultivated field (SW¼NW¼, sec. 10, T. 10 N., R. 20 E.):

Ap—0 to 8 inches, black (10YR 2/1) silt loam; moderate, medium, subangular blocky structure; friable; neutral; abrupt, smooth boundary.

A3—8 to 10 inches, very dark gray (10YR 3/1) silt loam; moderate, medium, subangular blocky structure; friable; neutral; abrupt, smooth boundary.

B21g—10 to 13 inches, grayish-brown (2.5Y 5/2) loam; many, medium, distinct mottles of yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/4); weak to moderate, medium, subangular blocky structure; friable; neutral; clear, wavy boundary.

B22g—13 to 16 inches, olive-gray (5Y 5/2) silt loam; many, fine, distinct mottles of yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/4); moderate, fine, subangular blocky structure; firm; thin, patchy clay films; mildly alkaline; clear, wavy boundary.

B3g—16 to 28 inches, light brownish-gray (2.5Y 6/2) silt loam; many, medium, distinct mottles of yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/4); weak, coarse, prismatic to moderate, medium, subangular blocky structure; friable; weakly calcareous; clear, wavy boundary.

Cg—28 to 60 inches +, light yellowish-brown (10YR 6/4) stratified silt and fine sand; many, medium, light-gray (10YR 7/2) and yellowish-brown (10YR 5/6) mottles; weak, medium, platy structure; friable; calcareous.

The A1 or Ap horizon generally is black (10YR 2/1), but it is very dark gray (10YR 3/1) in places. This horizon ranges from 9 to 12 inches in thickness. The thickness of the solum ranges from 24 to 36 inches. The C horizon ranges from mostly fine sand to mostly silt.

The lower horizons of Colwood soils are less pebbly and less stony than those in the Brookston soils, which formed in 10 to 20 inches of silty material over loamy till. In contrast to the Colwood soils, the Pella soils are silty and are more than 36 inches thick over loamy till. In the upper 36 inches, the Colwood soils are finer textured than the Keowns soils.

Colwood silt loam (0 to 2 percent slopes) (Cw).—This soil of the lowlands has a seasonal high water table and is subject to flooding. It has the profile described for the series, except in some areas where it has a thicker combined surface layer and subsoil. Included with this soil in mapping are areas that have slopes of more than 2 percent.

If drained and properly managed, this soil is suited to the crops commonly grown in the county. Areas not drained are severely limited if cultivated. (Capability unit IIw–3; woodland group 7; recreation group 3; wildlife group 2)

Darroch Series, Neutral Variant

The neutral variant from the Darroch series is a somewhat poorly drained, nearly level soil that formed from calcareous, lake-laid silt and fine sand. This variant is not so acid as is normal for the Darroch series.

In a typical profile this variant has a mildly alkaline, very dark gray fine sandy loam surface layer about 9 inches thick. Just below is about 2 inches of mildly alkaline, very dark grayish-brown fine sandy loam.

The subsoil is about 13 inches thick. The upper part is mildly alkaline, brown loam mottled with dark gray and yellowish brown. The lower part is weakly calcareous, brown sandy loam mottled with grayish brown and yellowish brown.

The substratum is calcareous, pale-brown fine sandy loam mottled with strong brown in the upper part. Below this is pale-brown very fine sandy loam mottled with yellowish brown and gray to light gray.

These soils can hold about 8 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, internal drainage is slow, and natural fertility is moderate.

After these soils are adequately drained, they can be used for corn, small grains, legumes, and other common crops. Most undrained areas are in pasture or trees.

Typical profile of Darroch fine sandy loam, neutral variant, 0 to 3 percent slopes, in a cultivated field (SW¼NW¼ sec. 6, T. 11 N., R. 20 E.):

Ap—0 to 9 inches, very dark gray (10YR 3/1) fine sandy loam; moderate, medium, granular structure; very friable; mildly alkaline; abrupt, smooth boundary.

A3—9 to 11 inches, very dark grayish-brown (10YR 3/2) fine sandy loam; weak, thick, platy structure; friable; many earthworm casts; mildly alkaline; clear, smooth boundary.

B2t—11 to 18 inches, brown (10YR 4/3) loam; common, medium, distinct mottles of dark gray (10YR 4/1) and yellowish brown (10YR 5/6); moderate, medium, angular blocky structure; friable; thick, continuous clay films; mildly alkaline; clear, wavy boundary.

B3—18 to 24 inches, brown (10YR 5/3) sandy loam; common, fine, distinct mottles of grayish brown (10YR 5/2) and yellowish brown (10YR 5/6); weak, medium, angular blocky structure; friable; weakly calcareous; clear, wavy boundary.

C1—24 to 27 inches, pale-brown (10YR 6/3) fine sandy loam; many, coarse, distinct (7.5YR 5/6) mottles of strong brown; massive; friable; calcareous; clear, wavy boundary.

C2—27 to 60 inches +, pale-brown (10YR 6/3) very fine sandy loam; few, fine, distinct mottles of yellowish brown (10YR 5/6) and gray to light gray (10YR 6/1); massive; friable; calcareous.

The Ap or A1 horizon ranges from very dark gray (10YR 3/1) to very dark brown (10YR 2/2) in color and from 7 to 10 inches in thickness. Thickness of the solum ranges from 24 to 30 inches. The C horizon ranges from sandy to silty.

The neutral variant from the Darroch series has a coarser textured solum that that of the Mundelein soils. It is finer

textured in the upper 30 inches of its profile than are the Yahara soils.

Darroch fine sandy loam, neutral variant, 0 to 3 percent slopes (DcA).—This soil has a seasonal high water table, and areas not drained have moderate limitations if used for cultivated crops. Drained areas are well suited to the crops commonly grown in the county. (Capability unit IIw–2; woodland group 7; recreation group 11; wildlife group 6)

Dodge Series

The Dodge series consists of soils of the uplands that are well drained and nearly level to gently sloping. These soils formed in 20 to 36 inches of loess underlain by calcareous loamy till.

In a typical profile the surface layer is mildly alkaline, dark grayish-brown silt loam about 7 inches thick. The next layer, about 3 inches thick, is neutral, brown silt loam.

The subsoil is about 22 inches thick. The upper part is slightly acid, yellowish-brown silty clay loam. The middle part is medium acid, yellowish-brown silty clay loam that has clay films on the soil aggregates, or peds. The lower part is mildly alkaline, brown silty clay loam to clay loam that has clay films on the soil aggregates.

The substratum is moderately calcareous, very pale brown loamy glacial till.

These soils can hold about 10 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, internal drainage is medium, and natural fertility is high.

Most of the acreage of these soils of the uplands is used for corn, small grains, legumes, and other cultivated crops common in this county. The steeper areas are in pasture or woodland.

Typical profile of Dodge silt loam, 2 to 6 percent slopes, in a cultivated field (SW¼SW¼ sec. 19, T. 9 N., R. 18 E.):

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; mildly alkaline; clear, wavy boundary.

A2—7 to 10 inches, brown (10YR 5/3) silt loam; weak, very thin, platy to weak, very fine, granular structure; friable; neutral; clear, wavy boundary.

B1—10 to 13 inches, yellowish-brown (10YR 5/4) silty clay loam; weak, fine, subangular blocky structure; firm; slightly acid; gradual, wavy boundary.

B21t—13 to 17 inches, yellowish-brown (10YR 5/4) silty clay loam; moderate, fine, subangular blocky structure; firm; thin, patchy clay films on ped faces; medium acid; gradual, wavy boundary.

B22t—17 to 27 inches, yellowish-brown (10YR 5/4) silty clay loam; strong, medium, angular blocky structure; firm; thick, continuous clay films on ped surfaces; medium acid; clear, wavy boundary.

IIB23t—27 to 32 inches, brown (7.5YR 5/4) heavy silty clay loam to clay loam; strong, medium, angular blocky structure; firm; thick, continuous clay films on all ped surfaces; mildly alkaline; abrupt, wavy boundary.

IIC—32 to 60 inches +, very pale brown (10YR 7/4) loam; weak, medium, subangular blocky structure to massive (structureless); friable; moderately calcareous.

The Ap horizon is generally dark grayish brown (10YR 4/2), but it is very dark grayish brown (10YR 3/2) in places. It ranges from 7 to 9 inches in thickness. In undisturbed areas the A1 horizon is less than 5 inches thick and generally is very dark gray (10YR 3/1). The solum ranges from 32 to 48 inches in thickness. The underlying till ranges from sandy loam to loam, and it is very cobbly or has pockets of stratified sand and gravel in places.

Dodge soils formed in a thicker mantle of loess than Theresa soils, which formed in loess 12 to 20 inches thick over loamy till. In contrast to Fox soils, the Dodge soils are underlain by loose, stratified sand and gravel.

Dodge silt loam, 0 to 2 percent slopes (DdA).—This soil has a combined surface layer and subsoil about 40 inches thick, or thicker than in the profile described as typical for the series.

Limitations to use of this soil for intensive cropping are few. Where good management is practiced, this soil is well suited to the crops commonly grown in the county. (Capability unit I–1; woodland group 1, recreation group 2; wildlife group 1)

Dodge silt loam, 2 to 6 percent slopes (DdB).—The profile of this soil is the one described as typical for the series. Unprotected areas are susceptible to erosion, which thins the surface layer and lowers fertility. Included in mapping are some areas that are eroded.

This soil of the uplands has moderate limitations if used for intensive cropping. It is well suited to the crops commonly grown in the county. Crops grow well if management is good. (Capability unit IIe–1; woodland group 1; recreation group 2; wildlife group 1)

Dresden Series

The Dresden series consists of well drained to moderately well drained, nearly level to gently sloping soils of the uplands. These soils formed in 24 to 40 inches of loess over calcareous, stratified sand and gravel.

In a typical profile the surface layer is mildly alkaline, very dark grayish-brown silt loam about 9 inches thick. The subsurface layer is mildly alkaline, dark grayish-brown silt loam about 5 inches thick.

The subsoil is about 18 inches thick. The upper part is slightly acid, brown heavy silt loam that has light brownish-gray coatings of silt on the soil aggregates, or peds. The middle part is slightly acid, dark yellowish-brown, gritty silty clay loam that has continuous clay films on the peds. The lower part is slightly acid, brown clay loam mottled with strong brown.

The substratum is neutral, brown loamy sand outwash in the upper part and calcareous, yellowish-brown medium sand below. This material is mottled with strong brown.

These soils can hold about 6 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, internal drainage is medium, and natural fertility is moderate.

Most of the more nearly level areas of these soils are used for corn, small grains, legumes, and other cultivated crops common in this county. The steeper areas are mostly pastured or wooded.

Typical profile of Dresden silt loam, 1 to 3 percent slopes, in a cultivated field (NW¼NE¼ sec. 18, T. 10 N., R. 19 E.):

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium, granular structure; very friable; mildly alkaline; abrupt, smooth boundary.

A2—9 to 14 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, platy structure; very friable; mildly alkaline; clear, wavy boundary.

B1—14 to 18 inches, brown (10YR 4/3) heavy silt loam; moderate, medium, angular blocky structure; very friable; few light brownish-gray (10YR 6/2) silt coatings; slightly acid; clear, wavy boundary.
B2t—18 to 25 inches, dark yellowish-brown (10YR 3/4) gritty silty clay loam; moderate, medium, subangular blocky structure; firm; continuous clay films on ped surfaces; slightly acid; clear, wavy boundary.
IIB3—25 to 32 inches, brown (7.5YR 4/4) clay loam; common, medium, distinct mottles of strong brown (7.5YR 5/6); moderate, coarse, angular blocky structure; firm; slightly acid; clear, wavy boundary.
IIC1—32 to 34 inches, brown (7.5YR 4/4) loamy sand; common, medium, distinct mottles of strong brown (7.5YR 5/6); single grain; loose; neutral; clear, wavy boundary.
IIC2—34 to 60 inches +, yellowish-brown (10YR 5/4) medium sand; few, fine, distinct mottles of strong brown (7.5YR 5/6); single grain; loose; calcareous.

The Ap horizon ranges from loam to silt loam. It generally is very dark grayish brown (10YR 3/2) in color and ranges from 7 to 9 inches in thickness. Undisturbed areas normally have a very dark gray (10YR 3/1) A1 horizon less than 6 inches thick. The B2 horizon ranges from clay loam to silty clay loam. The solum is 24 to 36 inches thick.

Dresden soils have a coarser textured substratum than the Mayville soils, which are underlain by loamy till.

Dresden silt loam, 1 to 3 percent slopes (DsA).—Small areas that have slopes of more than 3 percent are included in mapping. Some included areas have a sandy loam surface layer.

This soil of the uplands has few limitations to intensive cultivation. Crop growth is good if this soil is managed well. (Capability unit IIs–1; woodland group 1; recreation group 4; wildlife group 1)

Drummer Series

The Drummer series consists of nearly level soils that formed in more than 40 inches of loess. These soils are underlain by stratified sand and gravel. They occur on lowlands and are poorly drained.

In a typical profile the surface layer and subsoil are mildly alkaline. The surface layer is black silt loam about 11 inches thick. The subsoil, about 39 inches thick, is olive-gray silty clay loam in the upper part and olive-gray silt loam in the lower part. The subsoil is mottled with reddish brown, strong brown, and brown. The soil is underlain at a depth of 42 to 50 inches by dark-gray sandy outwash mottled with brown.

These soils can hold about 11 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, internal drainage is very slow, and natural fertility is high.

After these soils are adequately drained, they can be used for corn, small grains, legumes, and other common crops. Most undrained areas are in pasture or trees.

Typical profile of Drummer silt loam, gravelly substratum, in a cultivated field (NE¼SE¼ sec. 29, T. 9 N., R. 20 E.):

Ap—0 to 11 inches, black (10YR 2/1) silt loam; moderate, medium, granular structure; very friable; mildly alkaline; abrupt, smooth boundary.
B1g—11 to 16 inches, olive-gray (5Y 5/2) silty clay loam; common, medium, distinct mottles of reddish brown (5YR 4/4); moderate, medium, angular blocky structure; firm; patchy clay films on vertical ped surfaces; mildly alkaline; clear, smooth boundary.
B2g—16 to 28 inches, olive-gray (5Y 5/2) silt loam; few, medium, distinct mottles of strong brown (7.5YR 5/6); moderate, medium, prismatic structure; firm; patchy clay films on ped surfaces; mildly alkaline; clear, smooth boundary.
B31g—28 to 45 inches, olive-gray (5Y 5/2) silt loam; many, medium, distinct mottles of brown (7.5YR 4/4); weak, medium, subangular blocky structure; firm; mildly alkaline; abrupt, wavy boundary.
IIB32g—45 to 50 inches, olive-gray (5Y 5/2) loam; many, medium, distinct mottles of brown (7.5YR 5/6); weak, medium, subangular blocky structure; firm; mildly alkaline; clear, wavy boundary.
IICg—50 to 60 inches, dark-gray (2.5Y 4/0) fine sand; many distinct mottles of brown (7.5YR 5/5); structureless; mildly alkaline.

The A1 or Ap horizon ranges from 8 to 12 inches in thickness. It generally is black (10YR 2/1), but in places it is very dark gray (10YR 3/1).

Drummer soils have a coarser textured substratum than the Pella soils, which are underlain by loamy till. The loess in the Drummer soils is more than 40 inches thick, but that in the Sebewa soils is 24 to 40 inches thick.

Drummer silt loam, gravelly substratum (0 to 2 percent slopes) (Dt).—This soil of the lowlands has a high water table and is periodically flooded. If this soil is drained and properly managed, it is suited to the crops commonly grown in the county. Areas not drained have severe limitations if used for cultivated crops. (Capability unit IIw–2; woodland group 7; recreation group 3; wildlife group 2)

Fabius Series

The Fabius series consists of nearly level to gently sloping, somewhat poorly drained soils. These formed in 12 to 20 inches of loamy material over calcareous, stratified sand and gravel.

In a typical profile the surface layer is moderately alkaline, very dark gray loam about 9 inches thick.

The subsoil is mildly alkaline and about 9 inches thick. The upper part is yellowish-brown heavy loam mottled with dark gray and yellowish brown. The lower part is light yellowish-brown sandy loam mottled with gray and yellowish brown.

The substratum is calcareous, light yellowish-brown sandy outwash mottled with yellowish brown.

These soils can hold about 4 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, internal drainage is slow, and natural fertility is low.

After these soils are adequately drained, they can be used for corn, small grains, legumes, and other common crops. Most undrained areas are in pasture or trees.

Typical profile of Fabius loam, 1 to 3 percent slopes, in a cultivated field (NE¼SW¼ sec. 15, T. 12 n., R. 20 E.):

Ap—0 to 9 inches, very dark gray (10YR 3/1) loam; moderate, medium, granular structure; friable; moderately alkaline; abrupt, smooth boundary.
B2t—9 to 15 inches, yellowish-brown (10YR 5/4) heavy loam; many, medium, distinct mottles of dark gray (10YR 4/1) and yellowish brown (10YR 5/6); weak, medium, subangular blocky structure; friable; thin, patchy clay films on ped surfaces; mildly alkaline; clear, wavy boundary.
B3—15 to 18 inches, light yellowish-brown (10YR 6/4) sandy loam; common, medium, distinct mottles of gray (10YR 5/1) and yellowish brown (10YR 5/8); weak, medium,

angular blocky structure; friable; mildly alkaline; clear, wavy boundary.

C—18 to 60 inches +, light yellowish-brown (10YR 6/4) medium sand; few, fine, distinct mottles of yellowish brown (10YR 5/6); single grain; loose; calcareous.

The Ap horizon generally is very dark gray (10YR 3/1), but it is very dark grayish brown (10YR 3/2 in places. The A1 or Ap horizon ranges from 7 to 10 inches in thickness. Thickness of the solum ranges from 14 to 20 inches. The B2 horizon ranges from loam to clay loam. The substratum ranges from sandy to cobbly.

Fabius soils are more shallow than the Matherton soils, which have a solum that is 20 to 40 inches thick over the loose sand and gravel. In contrast to Fabius soils, which are underlain by sand and gravel, Nenno soils are underlain by loamy till.

Fabius loam, 1 to 3 percent slopes (FoA).—This soil has a seasonal high water table and is susceptible to periodic flooding. Included in mapping are some areas of a soil that has a silt loam or sandy loam surface layer. Also included are areas that have slopes of more than 3 percent.

Where this soil is drained and properly managed, it is suited to the crops commonly grown in the county. Areas not drained have moderate limitations if used for cultivated crops. (Capability unit IIw–3; woodland group 7; recreation group 4; wildlife group 6)

Fox Series

The Fox series consists of nearly level to moderately steep, well-drained soils of the uplands. These soils formed in stratified sand and gravel that is mantled with silt as much as 40 inches thick.

In a typical profile the surface layer is neutral, dark grayish-brown silt loam about 7 inches thick.

The subsoil is about 24 inches thick. The upper part is neutral, brown silt loam to silty clay loam. The middle part is slightly acid, brown silty clay loam. Below this is medium acid, brown and reddish-brown sandy clay loam. The lower part of the subsoil is neutral, brown and reddish-brown sandy loam.

The substratum is calcareous, very pale brown fine sand.

These soils can hold about 6 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, internal drainage is medium, and natural fertility is moderate.

In most areas these soils are used for corn, small grains, legumes, and other cultivated crops common in the county. Most areas of the steeper soils are in pasture and trees.

Typical profile of Fox silt loam, 2 to 6 percent slopes, in a cultivated field (SW¼NE¼ sec. 20, T. 12 N., R. 20 E.):

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, very fine, granular structure; friable; neutral; abrupt, wavy boundary.

B1—7 to 10 inches, brown (7.5YR 5/4) light silty clay loam; weak, medium, subangular blocky structure; friable; neutral; gradual, wavy boundary.

B21t—10 to 21 inches, brown (7.5YR 4/4) gritty silty clay loam; moderate, fine to medium, subangular blocky structure; firm; thick, continuous clay films on ped surfaces; slightly acid; gradual, wavy boundary.

IIB22t—21 to 24 inches, brown (7.5YR 4/4) and reddish-brown (5YR 4/4) sandy clay loam; moderate, medium, subangular blocky structure; friable; thin, patchy clay films on ped surfaces; medium acid; gradual, wavy boundary.

11B3—24 to 31 inches, brown (7.5YR 4/4) and reddish-brown (5YR 4/4) sandy loam; moderate, fine, subangular blocky structure; friable; neutral; gradual, wavy boundary.

11C—31 to 60 inches+, very pale brown (10YR 7/3) fine sand; single grain; loose; calcareous.

The Ap horizon is loam or silt loam. It generally is dark grayish brown (10YR 4/2), but it is very dark grayish brown (10YR 3/2) in places. It ranges from 7 to 9 inches in thickness. In undisturbed areas the A1 horizon generally is very dark gray (10YR 3/1) and is less than 4 inches thick. The solum ranges from 24 to 40 inches in thickness. The B2 horizon ranges from sandy clay loam to silty clay loam. The underlying material ranges from sandy to cobbly.

The Fox soils are deeper to sand and gravel than the Casco soils, which formed in less than 18 inches of silty material over stratified sand and gravel. In contrast to the Fox soils, Theresa soils are underlain by loamy till.

Fox silt loam, 0 to 2 percent slopes (FsA).—The combined surface layer and subsoil of this soil is about 36 inches thick, or thicker than in the profile described as typical for the series. Included with this soil in mapping are soils that have a loam surface layer.

This soil of the uplands has few limitations to intensive cultivation. Crop growth is good if this soil is managed well. (Capability unit IIs–1; woodland group 1; recreation group 2; wildlife group 1)

Fox silt loam, 2 to 6 percent slopes (FsB).—This soil generally has the profile described as typical for the series, but in parts of section 31 of Erin Township the underlying material is very cobbly outwash. In places this soil is undulating and has complex slopes. Included with this soil in mapping are areas of a Fox soil that has a loam surface layer and areas of more shallow Casco soils. Also included are eroded areas, where erosion has thinned the surface layer and reduced fertility.

This soil of the uplands is susceptible to erosion, and unprotected areas have moderate limitations if intensively cropped, Crops grow well, however, if management is good. (Capability unit IIe–2; woodland group 1; recreation group 2; wildlife group 1)

Granby Series

The Granby series consists of nearly level to gently sloping soils that formed in loose, neutral to calcareous sand. These soils occur on lowlands and are poorly drained.

In a typical profile the surface layer is mildly alkaline, black fine sandy loam about 11 inches thick. The subsoil, about 3 inches thick, is neutral, very dark gray loamy fine sand. The substratum is neutral, grayish-brown and pale-brown outwash consisting of medium and fine sand.

These soils can hold about 4 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderately rapid, internal drainage is very slow, and natural fertility is low.

After these soils are adequately drained, they can be used for corn, small grains, legumes, and other crops commonly cultivated in the county. Most undrained areas are in pasture or trees.

Typical profile of Granby fine sand loam, 0 to 3 percent slopes, in an undisturbed area (NW¼SW¼ sec. 10, T. 11 N., R. 19 E.):

A1—0 to 11 inches, black (10YR 2/1) fine sandy loam; weak,

medium, granular structure; very friable; mildly alkaline; abrupt, smooth boundary.

B1g—11 to 14 inches, very dark gray (10YR 3/1) loamy fine sand; weak, medium, angular blocky structure; very friable; neutral; clear, smooth boundary.

C1—14 to 36 inches, grayish-brown (2.5Y 5/2) medium and fine sand; few, fine, distinct, mottles of yellowish brown (10YR 5/6); single grain; loose; neutral; gradual, smooth boundary.

C2—36 to 60 inches +, pale-brown (10YR 6/3) medium and fine sand; single grain; loose; neutral.

The A1 or Ap horizon ranges from 8 to 12 inches in thickness. The underlying material generally is fine to medium sand, but thin layers of silt occur in places. The substratum is neutral to moderately alkaline.

Granby soils have a coarser textured profile than Keowns soils, which formed in silt and fine sand. In contrast to the Granby soils, the Mussey soils have 12 to 24 inches of loamy materials over sand and gravel.

Granby fine sandy loam, 0 to 3 percent slopes (GfA).—This soil has a seasonal high water table and is subject to flooding. It is suited to some crops where drainage is adequate and management is good, but drained areas are subject to soil blowing. Undrained areas have severe limitations if used for cultivated crops. (Capability unit IVw–1; woodland group 7; recreation group 10; wildlife group 5)

Grays Series

The Grays series consists of nearly level to gently sloping, well drained to moderately well drained soils that occur on uplands and formed in lake-laid silt and fine sand. In Washington County these soils contain more lime than is typical for the series.

A typical profile in this county has a mildly alkaline, very dark grayish-brown surface layer about 9 inches thick.

The subsoil is neutral and about 18 inches thick. The upper part is brown silty clay loam that has continuous clay films on the soil aggregates, or peds. The lower part is brown silty clay loam mottled with brown.

The substratum is calcareous, very pale brown laminated silt and fine sand mottled with strong brown.

These soils can hold about 11 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, internal drainage is medium, and natural fertility is moderate. Crops respond well to additions of fertilizer.

Most of the nearly level to sloping areas are used for corn, small grains, legumes, and other crops common in the county. Most of the steeper areas are in pasture or trees.

Typical profile of Grays silt loam, 0 to 2 percent slopes, in a cultivated field (SE¼SE¼ sec. 24, T. 11 N., R. 19 E.):

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium, granular structure; very friable; mildly alkaline; abrupt, smooth boundary.

B2t—9 to 16 inches, brown (10YR 4/3) silty clay loam; moderate, fine, subangular blocky structure; firm; continuous dark-brown (7.5YR 3/2) clay films; neutral; clear, wavy boundary.

B3t—16 to 27 inches, brown (10YR 4/3) silty clay loam; few, fine, distinct mottles of brown (7.5YR 5/4); moderate, fine, subangular blocky structure; firm; thin, patchy clay films on the ped surfaces; neutral; clear, wavy boundary.

C—27 to 60 inches +, very pale brown (10YR 7/4) laminated silt and fine sand; common, medium, distinct mottles of strong brown (7.5YR 5/8); weak, medium, platy structure; very friable; calcareous.

The Ap horizon generally is very dark grayish brown (10YR 3/2), but it is dark grayish brown (10YR 4/2) in places. This layer ranges from 7 to 9 inches in thickness. In undisturbed areas the A1 horizon generally is very dark gray (10YR 3/1) and less than 7 inches thick. The solum ranges from 24 to 36 inches thick. The substratum is fine sand or silt.

Grays soils have a finer textured substratum than the Fox soils, which are underlain by loose sand and gravel. In contrast to the Grays soils, which are underlain by silt and fine sand, the Mayville soils are underlain by loamy till.

Grays silt loam, 0 to 2 percent slopes (GrA).—This soil of the uplands has the profile described as typical for the series. Limitations to intensive cultivation are few on this soil, and crops grow well if management is good. (Capability unit I–1; woodland group 1; recreation group 8; wildlife group 1)

Grays silt loam, 2 to 6 percent slopes (GrB).—In this soil the thickness of the combined surface layer and subsoil is about 25 inches, or less than that in the profile described as typical for the series. Included with this soil in mapping are some moderately eroded areas, where the surface layer is thinner and dark grayish brown. The fertility is lower than in the nearly level soil.

Because this soil of the uplands is susceptible to erosion, it has moderate limitations if cultivated intensively. Under good management, crops grow well. (Capability unit IIe–1; woodland group 1; recreation group 8; wildlife group 1)

Hebron Series

The Hebron series consists of nearly level to gently sloping, well-drained soils that formed in stratified sand and gravel over lake-laid silt and clay.

In a typical profile the surface layer is mildly alkaline, dark grayish-brown loam about 7 inches thick. Below this is about 5 inches of slightly acid, dark grayish-brown loam.

The subsoil is about 15 inches thick. The upper part is neutral, brown clay loam and silty clay loam, in which clay films are continuous on the soil aggregates, or peds. The lower part is mildly calcareous, dark yellowish-brown silty clay loam.

The substratum is calcareous, light yellowish-brown laminated silt and clay.

These soils can hold about 10 inches of water available to plants between the surface and a depth of 5 feet. Permeability of the combined surface layer and subsoil is slow, internal drainage is medium, and natural fertility is moderate.

Most areas of the more nearly level soils are used for corn, small grains, legumes, and other cultivated crops common in the county. The more strongly sloping areas are in pasture or trees.

Typical profile of Hebron loam, 2 to 6 percent slopes, in a cultivated field (SE¼NW¼ sec. 3, T. 12 N., R. 19 E.):

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) loam; weak, medium, granular structure; very friable; mildly alkaline; abrupt, smooth boundary.

A2—7 to 12 inches, dark grayish-brown (10YR 4/2) loam; weak, medium, platy structure; very friable; slightly acid; clear, wavy boundary.
B21t— 12 to 20 inches, brown (7.5YR 4/4) clay loam; moderate, medium, subangular blocky structure; friable; continuous clay films on ped surfaces; neutral, wavy boundary.
IIB22t—20 to 24 inches, brown (7.5YR 4/4) silty clay loam; moderate, medium, angular blocky structure; firm; continuous clay films on the ped surfaces; neutral; gradual, wavy boundary.
IIB3—24 to 27 inches, dark yellowish-brown (10YR 4/4) silty clay loam; moderate, medium, angular blocky structure; firm; mildly calcareous; gradual, irregular boundary.
IIC—27 to 60 inches +, light yellowish-brown (10YR 6/4) laminated silt and clay; massive; firm; calcareous.

The Ap horizon ranges from 7 to 9 inches in thickness. In undisturbed areas the A1 horizon is very dark grayish brown (10YR 3/2) and less than 5 inches thick. Depth to the underlying silt and clay ranges from 18 to 40 inches. In some places the substratum contains thin layers of fine sand.

Hebron soils have a finer textured substratum than the Fox soils, which are underlain by loose sand and gravel. In contrast to the Hebron soils, the Saylesville soils formed entirely in silt and clay.

Hebron loam, 0 to 2 percent slopes (HeA).—This soil has a combined surface layer and subsoil about 36 inches thick, or somewhat thicker than in the profile described as typical for the series. Included in mapping are small areas that have a very dark grayish brown or sandy loam or silt loam surface layer.

Hebron loam, 0 to 2 percent slopes, has few limitations if intensively cropped, and crops grow well if management is good. (Capability unit IIs–2; woodland group 2; recreation group 6; wildlife group 1)

Hebron loam, 2 to 6 percent slopes (HeB).—This soil has the profile described as typical for the series. Included in mapping are areas that have a sandy loam or silt loam surface layer. Also included are moderately eroded areas in which the surface layer is thinned and fertility is lowered.

This soil of the uplands is susceptible to erosion and has moderate limitations if used for intensive cultivation. Under good management, crops grow well. (Capability unit IIe–3; woodland group 2; recreation group 6; wildlife group 1)

Hennepin Series

The Hennepin series consists of moderately steep to very steep, well-drained soils that formed in calcareous loamy till on uplands.

In a typical profile the surface layer is mildly alkaline, dark grayish-brown gravelly sandy loam about 4 inches thick. The subsoil, about 4 inches thick, is weakly calcareous, brown gravelly loam. The substratum is calcareous, light yellowish-brown gravelly sandy loam.

These soils have low available water capacity and moderately rapid permeability. Internal drainage is rapid, and natural fertility is low.

These soils generally are too steep and too shallow for cultivated crops. They are better suited to pasture, as woodland, or as wildlife habitat.

In Washington County, Hennepin soils are mapped only in complexes with Hochheim soils.

Typical profile of Hennepin gravelly sandy loam, 12 to 20 percent slopes, in an undisturbed area (SW¼NE¼ sec. 21, T. 10 N., R. 18 E.):

A1—0 to 4 inches, dark grayish-brown (10YR 4/2) gravelly sandy loam; weak, medium, granular structure; friable; mildly alkaline; clear, smooth boundary.
B—4 to 8 inches, brown (7.5YR 4/4) gravelly loam; weakly calcareous; gradual, irregular boundary.
C—8 to 60 inches, light yellowish-brown (10YR 6/4) gravelly sandy loam; massive; friable; calcareous.

The A1 horizon ranges from 3 to 5 inches in thickness. The substratum ranges from gravelly loam to gravelly sandy loam.

Hennepin soils have a thinner solum than the Hochheim soils, which have a solum 12 to 20 inches thick. In contrast to Hennepin soils, which formed in loamy till, Rodman soils formed in calcareous sand and gravel.

Hochheim Series

The Hochheim series consists of gently sloping to very steep, well-drained soils that formed in calcareous loamy till (fig. 14). In many places this till is mantled with loess as much as 12 inches thick.

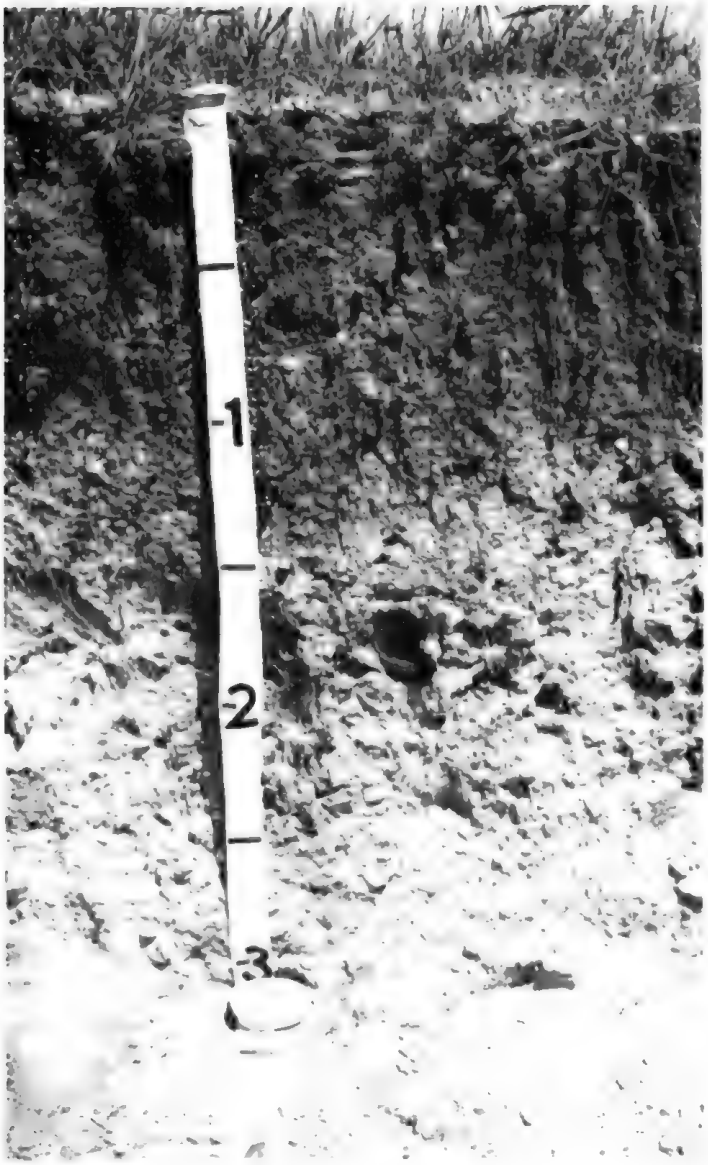

Figure 14.—Typical profile of Hochheim silt loam showing calcareous sandy loam glacial till at a depth of about 18 inches.

In a typical profile the surface layer is mildly alkaline, very dark grayish-brown silt loam about 7 inches thick.

The subsoil, about 11 inches thick, is mildly alkaline. The upper part is brown silty clay loam that has thick clay films on the soil aggregates, or peds. The middle part is reddish-brown clay loam that also has thick clay films on the peds. The lower part is brown loam.

The substratum is calcareous, yellowish-brown and brownish-yellow sandy loam glacial till.

These soils can hold about 7 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, internal drainage is medium, and natural fertility is moderate.

Most of the nearly level to sloping areas are used for corn, small grains, legumes, and other cultivated crops common in the county. Most of the steeper areas are in pasture or trees.

Typical profile of a Hochheim loam that is eroded, in a cultivated field (NW¼NW¼ sec. 10, T. 12 N., R. 19 E.):

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium, granular structure; very friable; many earthworm casts; mildly alkaline; abrupt, smooth boundary.

B21t—7 to 10 inches, brown (7.5YR 4.4) silty clay loam; moderate, medium, angular blocky structure; firm; thick, continuous clay films on peds; mildly alkaline; clear, smooth boundary.

IIB22t—10 to 16 inches, reddish-brown (5YR 4/4) clay loam; moderate, medium, angular blocky structure; firm; thick, continuous clay films on peds; mildly alkaline; clear, smooth boundary.

IIB3—16 to 18 inches, brown (7.5YR 4/4) loam; weak, medium, subangular blocky structure; friable; mildly alkaline; clear, smooth boundary.

IIC1—18 to 21 inches, yellowish-brown (10YR 5/4) sandy loam; weak, medium, subangular blocky structure; friable; calcareous; clear, wavy boundary.

IIC2—21 to 60 inches +, brownish-yellow (10YR 6/4) sandy loam; massive; friable; calcareous.

The Ap horizon is loam or silt loam. It ranges from 7 to 9 inches in thickness. In undisturbed areas the A1 horizon generally is very dark gray (10YR 3/1) and less than 5 inches thick. Thickness of the solum ranges from 14 to 24 inches. The underlying till ranges from sandy loam to loam in texture and from 10YR to 7.5YR in hue. In places the substratum has pockets of stratified sand and gravel or is very cobbly.

Hochheim soils are shallower than Theresa soils, which have 12 to 20 inches of silty material over till. Hochheim soils are underlain by loamy till, but Casco soils are underlain by stratified, loose sand and gravel.

Hochheim loam, 2 to 6 percent slopes (HmB).—In this soil the thickness of the combined surface layer and subsoil is more than that in the profile described as typical for the series, and the surface layer is loam instead of silt loam. Depth to the sandy loam till is about 22 inches. Some areas are undulating and have complex slopes. Included in mapping are areas that have a silt loam surface layer. Also included, in some parts of Barton, Polk, and West Bend Townships, are areas where the underlying material is silt loam or silty clay loam.

The hazard of erosion is slight on this soil, but most areas are in trees or pasture. (Capability unit IIe–1; woodland group 1; recreation group 2; wildlife group 1)

Hochheim loam, 2 to 6 percent slopes, eroded (HmB2).—This soil has a coarser textured surface layer than that in the profile described as typical for the series. The thickness of the combined surface layer and subsoil is about 20 inches, or is about 2 inches less than that in the profile described as typical for the series. Some areas have stones and cobblestones on the surface. The more eroded areas have a lighter colored surface layer. Unprotected areas are damaged by erosion, which thins the surface layer and reduces fertility. Included with this soil in mapping are many areas that have a silt loam surface layer. Also included, in Barton, Polk, and West Bend Townships, are areas where the underlying material is silt loam to silty clay loam.

This soil of the uplands is susceptible to further erosion. It has moderate limitations if intensively cropped. Where management is good, this soil is well suited to crops. (Capability unit IIe–1; woodland group 1; recreation group 2; wildlife group 1)

Hochheim loam, 6 to 12 percent slopes, eroded (HmC2).—This soil has a coarser textured, lighter colored surface layer than that in the profile described as typical for the series. The thickness of the combined surface layer and subsoil is about 20 inches, or about 2 inches less than in the profile described as typical. Some areas have stones and cobblestones on the surface. Included with this soil in mapping, in places used as pasture and woodland, are many areas that are only slightly eroded.

This Hochheim soil of the uplands is susceptible to further erosion. It has moderately severe limitations if intensively cultivated. (Capability unit IIIe–1; woodland group 1; recreation group 2; wildlife group 1)

Hochheim loam, 12 to 20 percent slopes, eroded (HmD2).—This soil has a coarser textured surface layer than that in the profile described as typical for the series. Some areas are hilly and have complex slopes (fig. 15). In unprotected areas, erosion thins the surface layer and reduces fertility. Included with this soil in mapping are many areas that have a silt loam surface layer. Also included are areas, in permanent pasture and woodland, that are only slightly eroded.

Strong slopes and the resulting erosion hazard severely limit this soil for field crops if it is intensively cultivated. (Capability unit IVe–1; woodland group 1; recreation group 2; wildlife group 1)

Hochheim loam, 20 to 30 percent slopes (HmE).—In this soil the thickness of the combined surface layer and subsoil is about 14 inches, or less than that in the profile described as typical for the series. Also, the surface layer is coarser textured. Stones and cobblestones are common on the surface of the soil. Unprotected areas are susceptible to erosion, which thins the surface layer and reduces fertility.

Included with this soil in mapping are areas of moderately eroded soils that have a lighter colored surface layer than that in the typical profile. Other inclusions on steep, complex slopes, are pockets of the deeper Theresa soils and, on the lower parts of slopes, soils that have a silt loam surface layer.

This soil of the uplands is well suited to pasture, as woodland, as wildlife habitat, and for recreational purposes. (Capability unit VIe–1; woodland group 1; recreation group 2; wildlife group 1)

Hochheim silt loam, 0 to 2 percent slopes (HnA).—This soil of the uplands grades toward the thicker Theresa soils. It has a combined surface layer and subsoil about 24 inches thick, or thicker than in the profile described

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Figure 15.—A **depression in a hilly area of a Hochheim loam. Many depressions of this kind occur in this county.**

as typical for the series. In some areas in Barton, Polk, and West Bend Townships, there are inclusions that have silt loam to silty clay loam underlying material.

This soil has few limitations if intensively cultivated. Under good management crops grow well. (Capability unit I–1; woodland group 1; recreation group 2; wildlife group 1)

Hochheim soils, 6 to 12 percent slopes, severely eroded (HoC3).—In these soils, the brownish subsoil material is exposed. In areas too small to map separately, the surface layer is loam, clay loam, silty clay loam, and sandy clay loam. Stones and cobblestones generally are exposed. Unprotected areas are severely damaged by erosion, which thins the surface layer and reduces fertility.

These soils of the uplands are susceptible to further erosion and have severe limitations if intensively cropped. Very careful management is needed to control erosion, and tilth is difficult to maintain. (Capability unit IVe–1; woodland group 1; recreation group 2; wildlife group 1)

Hochheim soils, 12 to 20 percent slopes, severely eroded (HoD3).—In these soils of the uplands, erosion has exposed the brownish subsoil and, in areas too small to map separately, the surface layer is loam, clay loam, silty clay loam, and sandy clay loam. Stones and cobblestones are common in these soils. In places these soils are hilly and have complex slopes.

These Hochheim soils are well suited to pasture and as woodland, wildlife habitat, and recreational areas. Because unprotected areas are severely damaged by erosion, careful management is needed. (Capability unit VIe–1; woodland group 1; recreation group 2; wildlife group 1)

Hochheim-Hennepin complex, 12 to 20 percent slopes (HrD).—This mapping unit is about 65 percent Hochheim soils and about 35 percent Hennepin soils.

The Hochheim soils in this unit generally have a coarser textured surface layer than that in the profile described as typical for the series. In most places the surface layer is loam. The Hennepin soils have the profile described as typical for the Hennepin series. Their surface layer generally is gravelly sandy loam. Included in mapping with these soils are many areas of a hilly soil that has complex slopes. Generally, the steeper Hennepin soils in this unit have convex slopes. Also included are areas of these soils that are moderately to severely eroded.

The soils in this complex are well suited to pasture, and as woodland, wildlife habitat, and recreational areas. Because unprotected areas are severely damaged by erosion, careful management is needed. (Capability unit IVe–1; woodland group 5; recreation group 13; wildlife group 4).

Hochheim-Hennepin complex, 20 to 30 percent slopes (HrE).—This mapping unit is about 60 percent Hochheim soils and about 40 percent Hennepin soils. The profile of the Hochheim soils has a thinner combined surface layer and subsoil than in the profile described as typical for the Hochheim series. This is because the Hochheim soils grade toward the thinner, coarser textured Hennepin soils. In most places the Hennepin soils have a thinner profile than that described as typical for the Hennepin series. In many places the soils in this mapping unit have complex slopes. The Hennepin soils generally are on the steeper slopes.

The soils in this complex are best suited as woodland, wildlife habitat, and recreational areas. Unprotected areas are severely damaged by erosion. Because some areas are moderately to severely eroded and gullies are forming, careful management is needed to maintain a plant cover that helps to control erosion. The steep slopes limit

the use of mechanical equipment on these soils. (Capability unit VIe–1; woodland group 5; recreation group 13; wildlife group 4)

Hochheim-Hennepin complex, 30 to 45 percent slopes (HrF).—This mapping unit is about 70 percent Hennepin soils and about 30 percent Hochheim soils. In the Hochheim soils the thickness of the combined surface layer and subsoil is less than that described as typical for the Hochheim series and the surface layer is coarser textured. This is because the Hochheim soils grade toward the thinner, coarser textured Hennepin soils. In most places the Hennepin soils also are thinner in the combined surface layer and subsoil than is typical for the Hennepin series, and in many places a clearly defined subsoil is missing. In many areas, the soils in this unit are very steep and have complex slopes. The Hennepin soils generally are on the steeper slopes. Included in mapping are some moderately eroded areas that have stones on the surface. Gullies have formed in places.

The soils in this complex are best suited as woodland and as wildlife and recreational areas. Mechanical tree planters are difficult to use on slopes of more than 30 percent. Because these soils are severely susceptible to erosion, careful management is needed to maintain the plant cover and to help control erosion. (Capability unit VIIe–1; woodland group 5; recreation group 13; wildlife group 4)

Houghton Series

The Houghton series consists of nearly level soils that formed from more than 42 inches of decaying reeds, grasses, and sedges. These soils are very poorly drained.

In a typical profile the surface layer is neutral, black mucky peat about 10 inches thick. The next layer, about 6 inches thick, is slightly acid, black peaty muck that has continuous films of organic matter on the soil aggregates, or peds. Below a depth of 16 inches is neutral, black mucky peat that contains dark-brown, partly decomposed plant remains.

These soils can hold more than 12 inches of water available to plants. Permeability is moderately rapid between the surface and a depth of 5 feet. Internal drainage is very slow, and natural fertility is low.

In some areas these organic soils are artificially drained and are used for corn and other cultivated crops. Areas that are drained and dry out are susceptible to soil blowing. Undrained areas are generally used for pasture, woodland, or wildlife habitat.

Typical profile of Houghton mucky peat in a cultivated field (NW¼NW¼ sec. 24, T. 9 N., R. 19 E.):

1—0 to 10 inches, black (7.5YR 2/0) mucky peat; weak, medium, granular structure; very friable; neutral; gradual, wavy boundary.

2—10 to 16 inches, black (7.5YR 2/0) peaty muck; moderate, thick, platy structure; friable; continuous organic films on the horizontal ped surfaces; slightly acid; gradual, wavy boundary.

3—16 to 22 inches, black (10YR 2/1) mucky peat; weak, thick, platy structure; friable; common, fine, dark-brown (7.5YR 3/2) sedge, grass, and reed fibers that are partly decomposed; neutral; gradual, wavy boundary.

4—22 to 60 inches +, black (10YR 2/1) mucky peat; weak, medium, subangular blocky structure; very friable; many, fine, dark-brown (10YR 3/3) sedge, grass, and reed fibers that are partly decomposed; neutral.

In some places Houghton soils have woody fragments and less decomposed fibrous materials than described as typical.

Houghton soils are more alkaline than the acid variant from the Houghton series, which is extremely acid. In contrast to Houghton soils, Palms soils are underlain by loamy materials at a depth ranging from 12 to 42 inches.

Houghton mucky peat (0 to 2 percent slopes) (Hu).—This soil is subject to flooding, especially along streams and around lakes. Included in mapping are areas that are gently sloping and cultivated areas that have a muck surface layer. Some areas adjacent to mineral soils have thin mineral deposits on the surface.

If it is drained and managed well, this soil is well suited to corn grown for silage and to specialty crops. Areas that are drained and dry out are susceptible to soil blowing. Areas not drained have very severe limitations if used for cultivated crops. (Capability unit IIIw–1; woodland group 10; recreation group 1; wildlife group 2)

Houghton Series, Acid Variant

The variant from the normal Houghton soils formed in more than 42 inches of decaying reeds, grasses, and sedges that have a thin mat of sphagnum moss on the surface. This variant is nearly level and very poorly drained.

In a typical profile the surface layer is a very strongly acid, dark reddish-brown mat of leatherleaf and mosses about 2 inches thick. The next layer, about 4 inches thick, is very strongly acid, black peat that consists of disintegrated sedges and remains of fibrous roots. It is underlain by dark-brown peat consisting of disintegrated sedges and some remains of woody stems.

This acid variant is very strongly acid or extremely acid. It can hold more than 12 inches of water available to plants between the surface and a depth of 5 feet. It has moderate permeability and very slow internal drainage. The natural fertility is low.

Because this variant is too acid for cultivated crops and is so difficult to drain, it is better suited as nature study areas and wildlife habitat.

Typical profile of Houghton peat, acid variant, in an undisturbed area (NW¼NW¼ sec. 17, T. 9 N., R. 19 E.):

1—0 to 2 inches, dark reddish-brown (5YR 2/2) fibrous mat of mosses and leatherleaf roots, stems, and leaves; very strongly acid; gradual, wavy boundary.

2—2 to 6 inches, black (5YR 2/1) peat disintegrated from sedges; many fibrous root and sedge remains; very strongly acid; gradual, wavy boundary.

3—6 to 13 inches, dark-brown (7.5YR 3/2) peat disintegrated from sedges; weakly matted with the remains of many leaves and stems of sedges; very strongly acid; gradual, wavy boundary.

4—13 to 24 inches, dark-brown (7.5YR 3/2) peat disintegrated from sedges; matted, brown to dark-brown (7.5YR 4/4) remains of the stems and leaves of sedges; very strongly acid; gradual, wavy boundary.

5—24 to 60 inches, dark-brown (7.5YR 3/2) peat disintegrated from sedges; matted, brown to dark-brown (7.5YR 4/4) fibrous remains of the stems and leaves of sedges; some woody stems and twig remains; very strongly acid.

The mat of moss on the surface ranges from less than 2 inches to nearly 12 inches in thickness.

The acid variant from the Houghton series is very strongly acid or extremely acid, and the normal Houghton soils are alkaline.

Houghton peat, acid variant (0 to 2 percent slopes) (Hv).—This soil of the lowlands is very strongly acid or extremely acid and generally does not have adequate drainage outlets. It is well suited as nature study and wildlife areas. (Capability unit VIIIw–1; woodland group 10; recreation group 1; wildlife group 7)

Juneau Series

The Juneau series consists of nearly level to gently sloping, well drained to moderately well drained soils that developed in more than 20 inches of recently deposited silty colluvium over older moderately well drained to poorly drained soils.

In a typical profile the soil material is mildly alkaline throughout. The surface layer (A horizon) is about 39 inches of silt loam that, from the surface downward, is dark brown, dark grayish brown, very dark brown, and grayish brown.

The subsoil is 21 inches thick or more. The upper part is brown silt loam, and the lower part is brown silty clay loam that has continuous clay films and patchy brown silica coats on the soil aggregates, or peds.

These soils can hold about 12 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderately slow, internal drainage is medium, and natural fertility is high. Crops respond well to additions of a complete fertilizer.

These soils are used for cultivated crops in most upland areas along drainageways, on foot slopes, and in small depressions. Among these crops are corn, small grains, and legumes. Some areas that are not cultivated are used for permanent pasture, woodland, or wildlife habitat.

Typical profile of Juneau silt loam, 1 to 3 percent slopes, in a cultivated field (SE¼SW¼ sec. 27, T. 10 N., R. 19 E.):

Ap—0 to 11 inches, dark-brown (10YR 3/3) silt loam; moderate, medium, granular structure; very friable; mildly alkaline; clear, smooth boundary.

A1—11 to 33 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, platy structure; very friable; mildly alkaline; clear, smooth boundary.

A1b—33 to 36 inches, very dark brown (10YR 2/2) silt loam; weak, medium, platy structure; very friable; mildly alkaline; clear, smooth boundary.

A2b—36 to 39 inches, grayish-brown (2.5Y 5/2) silt loam; moderate, medium, platy structure; very friable; mildly alkaline; clear, smooth boundary.

B1b—39 to 47 inches, brown (10YR 4/3) silt loam; moderate, medium, subangular blocky structure; friable; mildly alkaline; clear, smooth boundary.

B2bt—47 to 60 inches +, brown (10YR 4/3) silty clay loam; moderate, medium, subangular blocky structure; firm; patchy, pale-brown (10YR 6/3) silica coatings; continuous clay films on all ped surfaces; mildly alkaline.

The A1 horizon ranges from dark brown (10YR 3/3) to dark grayish brown (10YR 4/2). It ranges from 20 to 48 inches in thickness. Where the color of the Ap horizon is dark brown, (10YR 3/3) or darker, this horizon generally is less than 12 inches thick and is underlain by lighter colored, mainly dark grayish-brown (10YR 4/2), colluvial deposits as much as 40 inches thick.

Juneau soils do not have a horizon of clay accumulation as do the associated St. Charles soils.

Juneau silt loam, 1 to 3 percent slopes (JuA).—This soil is along drainageways in the uplands. It is likely to receive concentrated runoff from higher slopes. Included with this soil in mapping are some areas that have coarse-textured layers in the colluvial deposits.

This soil has few limitations to use for intensive cropping. (Capability unit I–1; woodland group 1; recreation group 4; wildlife group 1)

Kendall Series

The Kendall series consists of nearly level to gently sloping soils that formed in more than 36 inches of loess underlain by calcareous loamy till. These soils of the lowlands are somewhat poorly drained.

In a typical profile the surface layer is neutral, very dark grayish-brown silt loam about 9 inches thick.

The subsoil is about 41 inches thick. The upper part is neutral, grayish-brown silty clay loam mottled with strong brown and gray. Just below is neutral, light brownish-gray silty clay loam mottled with strong brown and light gray. The next layer is neutral, light yellowish-brown heavy silty loam that contains light-gray and strong-brown mottles. Below that layer is light brownish-gray gritty silt loam mottled with strong brown and dark gray.

The substratum is calcareous, grayish-brown loam mottled with gray and strong brown.

These soils can hold about 10 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, internal drainage is medium, and natural fertility is high. Crops respond well to additions of a complete fertilizer.

After these soils are adequately drained, they are used for corn, small grains, legumes, and other crops common in the county. Most undrained areas are in pasture or trees.

Typical profile of Kendall silt loam, 1 to 3 percent slopes, in a cultivated field (SE¼SW¼ sec. 29, T. 11 N., R. 18 E.):

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; very friable; neutral; abrupt, smooth boundary.

B21t—9 to 22 inches, grayish-brown (2.5Y 5/3) silty clay loam; few, medium, distinct mottles of gray (10YR 5/1) and many, fine, distinct mottles of strong brown (7.5YR 5/6); moderate, medium, angular blocky structure; firm; thin, patchy clay films on peds; neutral; clear, smooth boundary.

B22t—22 to 29 inches, light brownish-gray (2.5Y 6/3) silty clay loam; many, fine, distinct mottles of strong brown (7.5YR 5/6) and common, medium, distinct mottles of light gray (10YR 6/1); moderate, medium, angular blocky structure; firm; thin, patchy clay films on ped surfaces; neutral; clear, smooth boundary.

B31—29 to 42 inches, light yellowish-brown (2.5Y 6/4) heavy silt loam; many, medium, distinct mottles of light gray (10YR 6/1) and strong brown (7.5YR 5/6); weak, medium, subangular blocky structure; firm; neutral; clear, smooth boundary.

I–IIB32—42 to 50 inches, light brownish-gray (2.5Y 6/3) gritty silt loam; many, medium, distinct mottles of strong brown (7.5YR 5/6) and dark gray (10YR 4/1); weak, medium, subangular blocky structure; firm; mildly alkaline; clear, smooth boundary.

IIC—50 to 60 inches +, grayish-brown (2.5Y 5/2) loam; common, medium, distinct mottles of gray (2.5Y 5/0) and strong brown (7.5YR 5/6); massive; firm; common, white (2.5Y 8/2), decomposed limestone fragments; calcareous.

The Ap horizon ranges from 7 to 10 inches in thickness. In most undisturbed areas the A1 horizon is very dark gray (10YR 3/1) and less than 5 inches thick. The solum ranges from 42 to 60 inches in thickness. The underlying till ranges from sandy loam to loam in texture and in places contains pockets of stratified sand and gravel.

Kendall soils have a silty layer more than 36 inches thick over loamy till, but the Lamartine soils have a silty layer less than 36 inches thick over loamy till. In contrast to Kendall soils the Virgil soils having a gravelly substratum have more than 36 inches of silty soil over calcareous sand and gravel.

Kendall silt loam, 1 to 3 percent slopes (KlA).—This soil has a seasonal high water table and is periodically flooded. In the more sloping areas the erosion hazard is slight. In some areas the surface layer is very dark grayish brown.

Where adequately drained and properly managed, this soil is well suited to the crops commonly grown in the county. In areas not drained, limitations to use for cultivated crops are moderate. (Capability unit IIw–2; woodland group 7; recreation group 4; wildlife group 3)

Keowns Series

The Keowns series consists of nearly level soils that formed in laminated lake-laid silt and fine sand. These soils of the lowlands are poorly drained.

In a typical profile the surface layer is weakly calcareous, very dark gray silt loam about 8 inches thick.

The subsoil is about 16 inches thick. The upper part is weakly calcareous, grayish-brown fine sandy loam mottled with strong brown. The lower part is calcareous, light brownish-gray fine sandy loam mottled with yellowish brown.

The substratum is calcareous, gray laminated silt and fine sand that contains strong-brown mottles.

These soils can hold about 9 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, internal drainage is very slow, and natural fertility is low.

After these soils are adequately drained, they can be used for corn, small grains, legumes, and other cultivated crops commonly grown in the county. Most undrained areas are in pasture or trees.

Typical profile of Keowns silt loam in an undisturbed area (NE¼NE¼ sec. 27, T. 10 N., R. 20 E.):

A1—0 to 8 inches, very dark gray (10YR 3/1) silt loam; moderate, medium, granular structure; very friable; weakly calcareous; clear, smooth boundary.

B21g—8 to 17 inches, grayish-brown (2.5Y 5/2) fine sandy loam; few, fine, distinct mottles of strong brown (7.5YR 5/6); weak, medium, subangular blocky structure; very friable; weakly calcareous; clear, smooth boundary.

B22g—17 to 24 inches, light brownish-gray (2.5Y 6/2) fine sandy loam; many, coarse, distinct mottles of yellowish brown (10YR 5/8); weak, medium, subangular blocky structure; very friable; calcareous; clear, smooth boundary.

Cg—24 to 60 inches +, gray (5Y 5/1) laminated silt and fine sand; common coarse mottles of strong brown (7.5YR 5/8); massive; friable; calcareous.

The A1 horizon is silt loam and very fine sandy loam. The A1 or Ap horizon ranges from very dark gray (10YR 3/1) to black (10YR 2/1) in color and from 6 to 10 inches in thickness. The C horizon ranges from mostly very fine sand to mostly silt.

Keowns soils are coarser textured than the Colwood soils in the upper 30 inches of the profile. They are also coarser textured in the upper part of the profile than Brookston soils and are underlain by lake-laid silt and fine sand instead of by loamy till.

Keowns silt loam (0 to 2 percent slopes) (Km).—This soil of the lowlands has a seasonal high water table and is subject to periodic flooding. Included in mapping are some areas that have a sandy loam surface layer.

Where drained and properly managed, this soil is suited to the crops commonly grown in the county. Areas not drained have very severe limitations if used for cultivated crops. (Capability unit IVw–1; woodland group 7; recreation group 3; wildlife group 2)

Knowles Series

The Knowles series consists of nearly level to sloping soils that formed in 20 to 40 inches of loess over dolomite bedrock. These soils of the uplands are well drained. The Knowles soils in Washington County are less acid than is typical for the series.

In a typical profile in Washington County, the surface layer is neutral, very dark grayish-brown silt loam about 5 inches thick. Below this is about 4 inches of mildly alkaline, dark grayish-brown silt loam.

The subsoil is mildly alkaline and about 16 inches thick. The upper part is dark yellowish-brown silty clay loam. The lower part is dark-brown to brown silty clay loam and gritty silty clay loam. It is underlain by dolomite bedrock.

These soils can hold about 5 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, internal drainage is medium, and natural fertility is moderate.

These soils of the uplands are used mostly for corn, small grains, legumes, and other cultivated crops commonly grown in the county. Most of the more sloping areas are pastured or wooded.

Typical profile of Knowles silt loam, 1 to 6 percent slopes, in a cultivated area (SE¼SE¼ sec. 35, T. 9 N., R. 20 E.):

A1—0 to 5 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine, granular structure; friable; neutral; abrupt, smooth boundary.

A2—5 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, platy structure; friable; mildly alkaline; clear, wavy boundary.

B1—9 to 13 inches, dark yellowish-brown (10YR 3/4) silty clay loam; moderate, fine, subangular blocky structure; firm; grayish-brown (10YR 5/2) to light brownish-gray (10YR 6/2) silica coatings on the ped faces; mildly alkaline; gradual, wavy boundary.

B21t—13 to 21 inches, dark-brown (10YR 3/3) silty clay loam; weak, medium, prismatic that breaks to strong, fine, subangular blocky structure; firm; continuous, highly organic, very dark grayish-brown (10YR 3/2) clay films on the ped surfaces; mildly alkaline; gradual, irregular boundary.

IIB22t—21 to 25 inches, brown (10YR 4/3) gritty silty clay loam; weak, medium, prismatic that breaks to moderate, fine, subangular blocky structure; firm; continuous, highly organic, very dark grayish-brown (10YR 3/2) to very dark brown (10YR 2/2) clay films on the ped surfaces; calcareous; abrupt, smooth boundary.

IIR—25 to 60 inches +, dolomite.

The A1 horizon generally is less than 6 inches thick. In most cultivated areas, the Ap horizon is dark grayish brown (10YR 4/2), but it is very dark grayish brown (10YR 3/2)

in places. The lower part of the solum generally developed in glacial till.

Knowles soils are deeper to bedrock than Ritchey soils, which developed in silt loam less than 20 inches thick over bedrock. The Knowles soils are similar to Theresa soils but are underlain by dolomite instead of by loamy till.

Knowles silt loam, 1 to 6 percent slopes (KwB).—This soil of the uplands is susceptible to erosion. It has the profile described as typical for the series. Some areas are undulating and have complex slopes.

Included with this soil in mapping are small areas where dolomite bedrock is near or at the surface, and other areas where bedrock is at a depth of 5 to 8 feet. In addition, there are moderately eroded areas where erosion has thinned the surface layer and reduced fertility.

This soil has moderate limitations if intensively cultivated. If management is good, however, crops grow well. (Capability unit IIe 2; woodland group 1; recreation group 8; wildlife group 1)

Knowles silt loam, 6 to 12 percent slopes, eroded (KwC2).—The surface layer of this soil is lighter colored than the one in the profile described as typical for the series, and the thickness of the combined surface layer and subsoil is somewhat less, or about 21 inches. In unprotected areas, erosion thins the surface layer and lowers fertility. In places this soil is rolling and has complex slopes.

Included with this soil in mapping are some areas that have dolomite bedrock at or near the surface and some areas where bedrock is at a depth of 5 to 8 feet. Also included are wooded or pastured areas that are only slightly eroded.

This soil of the uplands is suitable for intensive cultivation, but careful management is needed to control erosion. (Capability unit IIIe–2; woodland group 1; recreation group 8; wildlife group 1)

Lamartine Series

The Lamartine series consists of nearly level to gently sloping soils that formed in 20 to 36 inches of loess over calcareous loamy till. These soils of the lowlands are somewhat poorly drained.

In a typical profile the surface layer is mildly alkaline, very dark gray silt loam about 9 inches thick. Below this is about 4 inches of dark grayish-brown silt loam.

The subsoil is mildly alkaline and about 23 inches thick. The upper part is very dark grayish-brown heavy silt loam mottled with yellowish brown and strong brown. The middle part is dark grayish-brown silty clay loam mottled with dark gray and strong brown. The lower part is olive-brown loam that contains mottles of dark gray and strong brown.

The substratum is calcareous, yellowish-brown sandy loam glacial till that is mottled with strong brown.

These soils can hold about 9 inches of water available for plants between the surface and a depth of 5 feet. Permeability is moderate, internal drainage is medium, and natural fertility is moderate.

After these soils are adequately drained, they are used for common cultivated crops, such as corn, small grains, and legumes. Most undrained soils are in pasture or trees.

Typical profile of Lamartine silt loam, 1 to 3 percent slopes, in a cultivated field (NW¼NW¼ sec. 8, T. 11 N., R. 18 E.):

Ap—0 to 9 inches, very dark gray (10YR 3/1) silt loam; moderate, medium, granular structure; friable; mildly alkaline; clear, smooth boundary.

A2—9 to 13 inches, dark grayish-brown (10YR 4/2) silt loam; common, fine, yellowish-brown (10YR 5/4-5/6) mottles; weak, medium, platy structure; mildly alkaline; clear, smooth boundary.

B1—13 to 17 inches, very dark grayish-brown (10YR 5/3) heavy silt loam; common, fine, yellowish-brown (10YR 5/4-5/6) mottles and few, faint, strong-brown (10YR 4/1) mottles; moderate, medium, subangular blocky structure; friable; continuous, very dark gray coatings of organic matter; mildly alkaline; clear, smooth boundary.

B2t—17 to 30 inches, dark grayish-brown (10YR 5/3) silty clay loam; common, medium, distinct mottles of dark gray (10YR 4/1) and strong brown (7.5YR 5/6); strong, medium, angular, blocky structure; firm; continuous, highly organic, very dark grayish-brown (10YR 3/2) clay films on the ped surfaces; mildly alkaline; clear, smooth boundary.

IIB3—30 to 36 inches, olive-brown (2.5Y 4/4) loam; common, medium, distinct mottles of dark gray (10YR 4/1) and many, medium, distinct mottles of strong brown (7.5YR 5/6); weak, medium, subangular blocky structure; friable; mildly alkaline; clear, smooth boundary.

IIC—36 to 60 inches +, yellowish-brown (10YR 5/4) sandy loam; many, medium, distinct mottles of strong brown (7.5YR 5/6); massive; friable; calcareous.

The A1 or Ap horizon generally is very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2). It is 6 to 10 inches thick. The solum ranges from 24 to 42 inches in thickness. The underlying till ranges from sandy loam to loam in texture and in places has pockets of sand and gravel.

Lamartine soils formed in a thinner layer of loess than the Kendall soils, which are more than 36 inches thick over the till. In contrast to Lamartine soils, the Matherton soils formed from medium-textured deposits that are 24 to 40 inches thick over loose sand and gravel.

Lamartine silt loam, 1 to 3 percent slopes (LmA).—This soil has a seasonal high water table. In the more sloping areas, surface drainage is better, but the hazard of erosion is slight. In some places the surface layer is less than 6 inches thick.

If drained and properly managed, this soil is well suited to the crops commonly grown in the county. In areas not drained, limitations to use for cultivated crops are moderate. (Capability unit IIw–2; woodland group 7; recreation group 4; wildlife group 3)

Loamy Land

Loamy land (Lu) consists of cut and filled areas in which the soil material ranges from sandy loam to silty clay loam. Filled areas range from 12 inches or less to several feet in thickness. Some filled areas are underlain by organic soils and others by sand or clay. Cut or borrow areas range from sandy loam to silty clay loam. Loamy land has finer textured material than that in gravel pits. In most places it has been graded and is suitable for vehicles and for building sites. (Capability unit VIIIs–1; woodland group 11; recreation group 13; not placed in a wildlife group)

Marsh

Marsh (0 to 2 percent slopes) (Mf) is lowland that has the water table above or near the surface throughout the year. It normally has a cover of cattails and marsh grasses. It generally is not suitable for drainage, because of its position in the landscape.

Marsh is well suited as a wildlife and recreational area. (Capability unit VIIIw–1; woodland group 11; recreation group 1; wildlife group 7)

Martinton Series

The Martinton series consists of nearly level to gently sloping soils that formed in lake-laid silt and clay. These soils are somewhat poorly drained.

In a typical profile the surface layer is mildly alkaline. It is very dark grayish-brown silt loam to a depth of about 8 inches. Below this is about 3 inches of dark grayish-brown silt loam.

The subsoil is about 12 inches thick. The upper part is mildly alkaline, dark grayish-brown light silty clay that contains mottles of dark yellowish brown to yellowish brown. The middle part is mildly alkaline, dark grayish-brown silty clay mottled with dark yellowish brown to yellowish brown and gray. The lower part is slightly calcareous, brown silty clay that contains mottles of dark yellowish brown to yellowish brown.

The substratum is calcareous, light yellowish-brown stratified silt and clay mottled with yellowish brown and light gray.

These soils can hold about 10 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderately slow, and natural fertility is high.

After these soils of the lowlands are adequately drained, they are used for corn, small grains, legumes, and other crops common in the county. Most undrained areas are in pasture or trees.

Typical profile of Martinton silt loam, 1 to 3 percent slopes, in a cultivated field (SW¼SW¼ sec. 13, T. 9 N., R. 20 E.):

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine, granular structure; friable; mildly alkaline; abrupt, smooth boundary.

A3—8 to 11 inches, dark grayish-brown (10YR 4/2) silt loam; few, fine, distinct mottles of yellowish brown (10YR 5/6); moderate, thin, platy structure; friable; mildly alkaline; clear, wavy boundary.

B1t—11 to 15 inches, dark grayish-brown (10YR 4/2) light silty clay; many fine, distinct mottles of dark yellowish brown (10YR 4/4) to yellowish brown (10YR 5/6); moderate, medium, prismatic breaking to strong, fine, angular blocky structure; firm; continuous, very dark grayish-brown (10YR 3/2) and very dark gray (10YR 3/1), highly organic clay films on ped surfaces; mildly alkaline; gradual, wavy boundary.

B2t—15 to 21 inches, dark grayish-brown (10YR 4/2) silty clay; many, medium, distinct mottles of dark yellowish brown (10YR 4/4) to yellowish brown (10YR 5/6) and gray (10YR 6/1); weak to moderate, coarse, prismatic to strong, angular blocky and subangular blocky structure; firm; continuous, very dark grayish-brown (10YR 3/2), highly organic clay films on the ped surfaces; mildly alkaline; abrupt, wavy boundary.

B3t—21 to 23 inches, brown (10YR 4/3) silty clay; many, medium, distinct mottles of dark yellowish brown (10YR 4/4) to yellowish brown (10YR 5/6); weak, coarse, prismatic to moderate, medium, subangular blocky structure; firm; continuous, very dark grayish-brown (10YR 3/2), highly organic clay films on the ped surfaces; firm; slightly calcareous.

C—23 to 60 inches +, light yellowish-brown (10YR 6/4) stratified silt and clay; many, medium, distinct mottles of yellowish brown (10YR 5/6) and light gray (10YR 7/2); massive; firm; calcareous.

The A1 or Ap horizon generally is very dark grayish brown (10YR 3/2) but in places is very dark brown (10YR 2/2). It ranges from 8 to 11 inches in thickness. The solum is 20 to 30 inches thick. The underlying lake-laid deposits are mostly silt and clay, but in places they have thin layers of fine sand.

Martinton soils are finer textured than the Mundelein soils. In contrast to the Martinton soils, the Lamartine soils have 18 to 36 inches of silty material over loamy till.

Martinton silt loam, 1 to 3 percent slopes (MgA).—This soil is subject to periodic flooding and has a seasonal high water table. In the more sloping areas, surface drainage is more rapid and the hazard of erosion is slight.

If this soil is drained and properly managed, it is well suited to the crops commonly grown in the county. Undrained areas have moderate limitations if used for cultivated crops. (Capability unit IIw–2; woodland group 7; recreation group 4; wildlife group 3)

Matherton Series

The Matherton series consists of nearly level to gently sloping soils that formed in 24 to 40 inches of loamy deposits over calcareous stratified sand and gravel. These soils of the lowlands are somewhat poorly drained.

In a typical profile the surface layer is mildly alkaline, very dark brown silt loam about 7 inches thick.

The subsoil is about 21 inches thick. The upper part is neutral, grayish-brown to dark grayish-brown silty clay loam mottled with strong brown. The lower part is mildly alkaline, grayish-brown clay loam and loam mottled with strong brown and light gray.

The substratum is calcareous, very pale brown sand and gravel outwash mottled with brownish yellow.

These soils can hold about 5 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, internal drainage is slow, and natural fertility is moderate.

After these soils are adequately drained, they can be used for corn, small grains, legumes, and other crops commonly grown in the county. Most undrained areas are in pasture or trees.

Typical profile of Matherton silt loam, 1 to 3 percent slopes, in a cultivated field (NW¼SE¼ sec. 27, T. 11 N., R. 18 E.):

Ap—0 to 7 inches, very dark brown (10YR 2/2) silt loam; moderate, medium, granular structure; very friable; mildly alkaline; abrupt, smooth boundary.

B21—7 to 12 inches, dark grayish-brown (10YR 4/2) silty clay loam; few, fine, distinct mottles of strong brown (7.5YR 5/6); moderate, fine, subangular blocky structure; friable; neutral; clear, smooth boundary.

B22t—12 to 17 inches, grayish-brown (2.5YR 5/2) gritty silty clay loam; common, medium, distinct mottles of strong brown (7.5YR 5/6) and light gray (10YR 6/1); moderate, medium, subangular blocky structure; friable; few, patchy clay films on ped faces; neutral; clear, smooth boundary.

IIB23t—17 to 21 inches, grayish-brown (2.5YR 5/2) clay loam; many, medium, distinct mottles of strong brown (7.5YR 5/6); moderate, medium, subangular blocky struc-

ture; friable; thin, patchy clay films; mildly alkaline; clear, smooth boundary.

IIB3—21 to 28 inches, grayish-brown (2.5Y 5/2) loam; many, medium, distinct mottles of strong brown (7.5YR 5/6) and light gray (10YR 6/1); weak, fine, angular blocky structure; very friable; mildly alkaline; clear, smooth boundary.

IIC—28 to 60 inches, very pale brown (10YR 7/4) sand and gravel; few, medium, distinct mottles of brownish yellow (10YR 6/8); single grain; loose; calcareous.

The A horizon is loam or silt loam. The Ap or A1 horizon generally is very dark brown (10YR 2/2), but it is very dark grayish brown (10YR 3/2) in places. It ranges from 6 to 10 inches in thickness. The B2 horizon ranges from silty clay loam to clay loam. The substratum is sandy or gravelly.

Matherton soils are deeper than the Fabius soils, which consist of less than 24 inches of loamy soil over sand and gravel. In contrast to Matherton soils, Lamartine soils have 18 to 36 inches of silty material over loamy till.

Matherton silt loam, 1 to 3 percent slopes (MmA).—This soil has a seasonal high water table. In the more sloping areas, surface drainage is more rapid and the hazard of erosion is slight. Included with this soil in mapping are some areas that have a loam or sandy loam surface layer.

If this soil is drained and properly managed, it is well suited to the crops commonly grown in the county. In undrained areas it has moderate limitations if used for cultivated crops. (Capability unit IIw–3; woodland group 7; recreation group 4; wildlife group 3)

Mayville Series

The Mayville series consists of nearly level to sloping soils that formed in 20 to 36 inches of silt over calcareous loamy till. These soils of the uplands are moderately well drained.

In a typical profile the surface layer is mildly alkaline, dark grayish-brown silt loam about 9 inches thick. Below this is mildly alkaline, brown silt loam about 2 inches thick.

The subsoil is about 23 inches thick. The upper part is mildly alkaline, brown silty clay loam mottled with strong brown. The lower part is mildly alkaline, brown clay loam mottled with strong brown.

The substratum is mildly alkaline, yellowish-brown sandy loam glacial till.

These soils can hold about 9 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, internal drainage is medium, and natural fertility is moderate.

Most of the acreage of these soils is used for cultivated crops common in the county, such as corn, small grains, and legumes.

Typical profile of Mayville silt loam, 2 to 6 percent slopes, in a cultivated field (NW¼SW¼ sec. 32, T. 12 N., R. 18 E.):

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; very friable; mildly alkaline; abrupt, smooth boundary.

A2—9 to 11 inches, brown (10YR 5/3) silt loam; weak, medium, platy structure; very friable; common, dark grayish-brown (10YR 4/2) earthworm casts; mildly alkaline; abrupt, smooth boundary.

B21t—11 to 23 inches, brown (10YR 4/3) silty clay loam; few, fine, distinct mottles of strong brown (7.5YR 5/6); moderate, medium, angular blocky structure; friable; thin, patchy clay films; mildly alkaline; clear, smooth boundary.

IIB22t—23 to 34 inches, brown (7.5YR 4/4) clay loam; common, fine, distinct mottles of strong brown (7.5YR 5/6) and brownish gray (10YR 5/2); moderate, medium, angular blocky structure; friable; continuous clay films on vertical and horizontal ped surfaces; mildly alkaline; clear, smooth boundary.

IIC1—34 to 38 inches, brown (7.5YR 4/4) loam; many, medium, faint mottles of strong brown (7.5YR 5/6) and grayish brown (10YR 5/2); friable; mildly alkaline; clear, smooth boundary.

IIC2—38 to 60 inches +, yellowish-brown (10YR 5/4) sandy loam; massive; friable; mildly alkaline.

The Ap horizon ranges from 7 to 10 inches in thickness. In most undisturbed areas the A1 horizon is dark gray (10YR 3/1) and less than 5 inches thick. The solum is 24 to 42 inches thick. The underlying till ranges from sandy loam to loam, and in places, has pockets of sand and gravel or is very cobbly. Mayville soils are more shallow to loamy till than St. Charles soils, which have more than 36 inches of silty soil over loamy till.

Mayville silt loam, 0 to 2 percent slopes (MoA).—In this soil the thickness of the combined surface layer and subsoil is about 38 inches, or somewhat more than that in the profile described as typical for the series. In some areas of this soil near Hartford, part of the B horizon formed in a thin layer of outwash. Included with this soil in mapping are some areas that have a combined surface layer and subsoil somewhat less than 38 inches thick and some areas that have a very dark grayish brown surface layer.

This soil of the uplands has few limitations if intensively cropped. (Capability unit I–1; woodland group 1; recreation group 8, wildlife group 1)

Mayville silt loam, 2 to 6 percent slopes (MoB).—In places this soil of the uplands is undulating and has complex slopes. It has the profile described as typical for the series.

Included with this soil in mapping are areas near Hartford where part of the subsoil formed in a thin layer of outwash. Also included are some areas that are moderately eroded and are thinner in the combined surface layer and subsoil.

This soil is susceptible to erosion and has moderate limitations if intensively cropped. Crops grow well if management is good. (Capability unit IIe–1; woodland group 1; recreation group 8; wildlife group 1)

Mequon Series

The Mequon series consists of nearly level to gently sloping soils that formed in calcareous silty clay loam till. These soils are somewhat poorly drained.

In a typical profile the surface layer and subsoil are mildly alkaline. The surface layer is very dark grayish-brown silt loam about 7 inches thick. Below this is about 4 inches of grayish-brown silty clay loam.

The subsoil is about 15 inches thick. It is brown silty clay mottled with gray and strong brown.

The substratum is calcareous, brown silty clay loam that is also mottled with gray and strong brown.

These soils can hold about 11 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderately slow, internal drainage is slow, and natural fertility is moderate.

After these soils are adequately drained, they can be used for corn, small grains, legumes, and other cultivated crops common in the county. Areas not drained are in pasture or trees.

Typical profile of Mequon silt loam, 1 to 3 percent slopes, in an undisturbed area (NW¼NW¼ sec. 24, T. 9 N., R. 20 E.):

A1—0 to 7 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium, granular structure; friable; mildly alkaline; clear, smooth boundary.

A2—7 to 11 inches, grayish-brown (10YR 5/2) silty clay loam; many, medium, distinct mottles of brown (7.5YR 5/4); moderate, thick, platy to moderate, medium, subangular blocky structure; friable; mildly alkaline; clear, smooth boundary.

B2t—11 to 26 inches, brown (10YR 5/3) silty clay; many, medium, distinct mottles of gray (10YR 6/1) and strong brown (7.5YR 5/6); moderate, medium, subangular blocky structure; firm; continuous clay films on ped surfaces; mildly alkaline; clear, smooth boundary.

C—26 to 48 inches +, brown (7.5YR 5/4) silty clay loam; common, medium, distinct mottles of gray (10YR 6/1) and strong brown (7.5YR 5/6); massive; firm; calcareous.

The A1 horizon ranges from 4 to 7 inches in thickness. In disturbed areas the Ap horizon is 7 to 9 inches thick.

Mequon soils formed in silty clay loam till, but Nenno soils formed in less than 12 inches of silty material over sandy loam to loam till.

Mequon silt loam, 1 to 3 percent slopes (MtA).—These soils have a seasonal high water table and are subject to periodic flooding. In the more sloping areas, surface drainage is more rapid and the hazard of erosion is slight.

If this soil is drained and properly managed, it is well suited to the crops commonly grown in the county. Areas not drained have moderate limitations if used for cultivated crops. (Capability unit IIw–2; woodland group 7; recreation group 4; wildlife group 3)

Montgomery Series

The Montgomery series consists of nearly level soils that formed in lake-laid silt and clay. These soils of the lowlands are poorly drained.

In a typical profile the surface layer is mildly alkaline, black silty clay loam about 6 inches thick. Below this is about 5 inches of mildly alkaline, very dark grayish-brown silty clay mottled with yellowish brown.

The subsoil is about 21 inches thick. The upper part is mildly alkaline, olive-gray silty clay mottled with yellowish brown. The lower part is slightly calcareous, brown light silty clay mottled with light grayish brown and yellowish brown.

The substratum is slightly calcareous, brown silty clay to silty clay loam mottled with light brownish gray, brown, and yellowish brown.

These soils can hold about 11 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderately slow, internal drainage is very slow, and natural fertility is high.

After these soils are adequately drained, they can be used for corn, small grains, legumes, and other common cultivated crops. Most undrained areas are used for pasture or trees.

Typical profile of Montgomery silty clay loam in an uncultivated area (SE¼NW¼ sec. 33, T. 9 N., R. 20 E.):

A1—0 to 6 inches, black (10YR 2/1) silty clay loam; moderate, medium, granular structure; firm; mildly alkaline; clear, wavy boundary.

A3g—6 to 11 inches, very dark grayish-brown (10YR 3/2) silty clay; few, fine, distinct mottles of yellowish brown (10YR 5/6); weak, medium, subangular blocky that breaks to moderate, medium, granular structure; firm; mildly alkaline; clear, wavy boundary.

B1g—11 to 15 inches, olive-gray (5Y 5/2) silty clay; many, medium, distinct mottles of yellowish brown (10YR 5/6); moderate, fine, subangular blocky structure; patchy clay films on the ped surfaces; firm; mildly alkaline; clear, wavy boundary.

B2g—15 to 26 inches, olive-gray (5Y 5/2) light silty clay; many, medium, distinct mottles of yellowish brown (10YR 5/6); moderate, fine, angular blocky structure; patchy clay films on the ped surfaces; firm; mildly alkaline; clear, wavy boundary.

B3g—26 to 32 inches, brown (10YR 5/3) light silty clay; many, medium, distinct mottles of light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) to brown (10YR 4/4); moderate, medium, angular to subangular blocky structure; firm; slightly calcareous; clear, smooth boundary.

Cg—32 to 60 inches +, brown (10YR 5/3) silty clay to silty clay loam; many, coarse, prominent mottles of light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) to brown (10YR 4/4); moderate, medium, angular blocky to subangular blocky structure; firm; calcareous.

The A1 horizon and A3g horizons combined range from 9 to 12 inches in thickness. The solum is 24 to 36 inches thick. The B2g horizon ranges from heavy silty clay loam to light silty clay. The substratum is mostly lake-laid silt and clay, but in places thin layers of fine sand occur.

Montgomery soils are finer textured than Pella soils, which formed in more than 36 inches of loess. Montgomery soils formed in lake-laid silt and clay, but Colwood soils formed in lake-laid silt and fine sand.

Montgomery silty clay loam (0 to 2 percent slopes) (Mzb).—This soil has a high water table and is subject to periodic flooding. Included with this soil in mapping are areas where slopes are more than 2 percent.

If this soil is adequately drained and properly managed, it is suited to the crops commonly grown in the county. Areas not drained have severe limitations if used for cultivated crops. (Capability unit IIw–1; woodland group 7; recreation group 3; wildlife group 2)

Mundelein Series

The Mundelein series consists of nearly level soils that formed in calcareous, lake-laid silt and fine sand. These soils are somewhat poorly drained.

In a typical profile the surface layer is mildly alkaline, very dark brown silt loam about 11 inches thick.

The subsoil is mildly alkaline and about 15 inches thick. The upper part is dark grayish-brown silt loam mottled with strong brown. The middle part is brown silty clay loam mottled with light gray and strong brown. The lower part is pale-brown silt loam that contains mottles of strong brown and gray to light gray.

The substratum is calcareous, pale-brown laminated silt and fine sand mottled with strong brown and yellow.

These soils can hold about 11 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, internal drainage is slow, and natural fertility is moderate.

After these soils are adequately drained, they can be used for corn, small grains, legumes, and other cultivated

crops common in the county. Undrained areas are mostly in pasture or trees.

Typical profile of Mundelein silt loam, 1 to 3 percent slopes, in a cultivated field (SE¼SE¼ sec. 24, T. 11 N., R. 19 E.):

Ap—0 to 11 inches, very dark brown (10YR 2/2) silt loam; moderate, medium, granular structure; friable; mildly alkaline; abrupt, smooth boundary.

B21t—11 to 17 inches, dark grayish-brown (10YR 4/2) heavy silt loam; common, medium, distinct mottles of strong brown (7.5YR 5/6); moderate, medium, angular blocky structure; friable; thin, patchy clay films; mildly alkaline; clear, smooth boundary.

B22t—17 to 22 inches, brown (10YR 5/3) silty clay loam; few, fine, faint mottles of light gray (10YR 7/1) and many, medium, distinct mottles of strong brown (7.5YR 5/6); moderate, medium, angular blocky structure; friable; mildly alkaline; patchy clay films on the ped surfaces; smooth boundary.

B3—22 to 26 inches, pale-brown (10YR 6/3) silt loam; many, medium, distinct mottles of strong brown (7.5YR 5/6) and gray (10YR 6/1); moderate, medium, angular blocky structure; very friable; many dark-gray (10YR 4/1) earthworm casts; mildly alkaline; clear, smooth boundary.

C—26 to 60 inches +, pale-brown (10YR 6/3) laminated silt and fine sand; many, coarse, distinct mottles of strong brown (7.5YR 5/6) and yellow (10YR 7/8); weak, medium, platy structure; very friable; calcareous.

The Ap or A1 horizon generally is very dark brown (10YR 2/2), but it is very dark gray (10YR 3/1) in places. It ranges from 7 to 11 inches in thickness. The solum is 24 to 36 inches thick. The C horizon is fine sand or silt.

In contrast to the Mundelein soils, the Lamartine soils have 18 to 36 inches of silty soil over loamy till. Mundelein soils are similar to Yahara soils but are not so coarse textured above the fine sand and silt underlying material.

Mundelein silt loam, 1 to 3 percent slopes (MzfA).—This soil has a water table that seasonally is high. Included in mapping are soils where slopes are more than 3 percent and erosion is more likely than on this soil.

If this soil is adequately drained and properly managed, it is well suited to the crops commonly grown in the county. Areas not drained have moderate limitations if used for cultivated crops. (Capability unit IIw–2; woodland group 7; recreation group 4; wildlife group 6)

Mussey Series

The Mussey series consists of nearly level to gently sloping soils that formed in 12 to 24 inches of loamy deposits over calcareous, stratified sand and gravel. These soils are poorly drained.

In a typical profile the surface layer is mildly alkaline, black loam about 9 inches thick. The subsoil, about 8 inches thick, is mildly alkaline, olive-gray sandy clay loam mottled with strong brown. The substratum is calcareous. It is grayish-brown loamy sand mottled with strong brown in the upper part and light brownish-gray sand and gravel outwash in the lower part.

These soils can hold about 4 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, internal drainage is very slow, and natural fertility is moderate.

After these soils are adequately drained, they can be used for the crops commonly cultivated, such as corn, small grains, and legumes. Undrained areas are used mostly for pasture or trees.

Typical profile of Mussey loam, 0 to 3 percent slopes, in a cultivated field (NW¼SW¼ sec. 26, T. 11 N., R. 18 E.):

Ap—0 to 9 inches, black (10YR 2/1) loam; moderate, medium, subangular blocky structure; friable; mildly alkaline; abrupt, smooth boundary.

Btg—9 to 17 inches, olive-gray (5Y 5/2) sandy clay loam; few, fine, distinct mottles of strong brown (7.5YR 5/6); moderate, medium, angular blocky structure; friable; thin, patchy clay films; mildly alkaline; clear, wavy boundary.

C1—17 to 23 inches, grayish-brown (2.5Y 5/2) loamy sand; many, coarse, distinct mottles of strong brown (7.5YR 5/6); single grain; loose; calcareous; clear, wavy boundary.

C2—23 to 42 inches +, light brownish-gray (2.5Y 6/2) sand and gravel; single grain; loose; calcareous.

The Ap horizon is loam and silt loam. It generally is black (10YR 2/1), but it is very dark gray (10YR 3/1) in places. It ranges from 9 to 12 inches in thickness. The Btg horizon ranges from sandy clay loam to silty clay loam. The substratum is sandy or gravelly.

Mussey soils are about 23 inches deep over sand and gravel, but the Sebewa soils have 24 to 40 inches of loamy material over sand and gravel. In contrast to Mussey soils, the Brookston soils formed in a silty layer less than 20 inches thick over loamy till.

Mussey loam, 0 to 3 percent slopes (MzkA).—This soil of the lowlands has a high water table and is subject to periodic flooding. In the more sloping areas, the hazard of erosion is slight but surface drainage is better than in the more nearly level areas. Included with this soil in mapping are some areas that have a silt loam surface layer and areas where slopes are more than 3 percent.

Where adequately drained and properly managed, this soil is well suited to the crops commonly grown in the county. Areas not drained have severe limitations if used for cultivated crops. (Capability unit IIw–3; woodland group 7; recreation group 3; wildlife group 2)

Nenno Series

The Nenno series consists of nearly level to gently sloping soils that formed in less than 12 inches of silty soil over calcareous loamy till. These soils of the uplands are somewhat poorly drained.

In a typical profile the surface layer and subsoil are mildly alkaline. The surface layer is very dark brown silt loam about 8 inches thick. The subsoil, about 10 inches thick, is brown clay loam mottled with gray and strong brown. The substratum is calcareous, light yellowish-brown loamy glacial till mottled with light gray and strong brown.

These soils can hold about 10 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, internal drainage is slow, and natural fertility is moderate.

After these soils are adequately drained, they can be used for corn, small grains, legumes, and other cultivated crops commonly grown in the county. Areas not drained are used mostly for pasture or trees.

Typical profile of Nenno silt loam, 1 to 3 percent slopes, in a cultivated field (NE¼SE¼ sec. 20, T. 10 N., R. 20 E.):

Ap—0 to 8 inches, very dark brown (10YR 2/2) silt loam; moderate, medium, granular structure; friable; mildly alkaline; abrupt, smooth boundary.

B2tg—8 to 18 inches, brown (10YR 5/3) clay loam; common, fine, distinct mottles of gray (10YR 6/1) and strong brown (7.5YR 5/6); moderate, medium, subangular blocky structure; friable; patchy clay films on ped surfaces; mildly alkaline; clear, wavy boundary.

C—18 to 60 inches +, light yellowish-brown (10YR 6/4) loam; common, medium, distinct mottles of strong brown (7.5YR 5/6) and few, fine, distinct mottles of light gray (10YR 7/1); massive; friable; calcareous.

The Ap horizon is generally very dark brown (10YR 2/2), but it is very dark grayish brown (10YR 3/2) in places. It ranges from 7 to 10 inches in thickness. In places the Ap horizon is silt loam that feels gritty. In undisturbed areas the A1 horizon generally is very dark gray (10YR 3/1) to black (10YR 2/1) and is 5 to 7 inches thick. The B2 horizon ranges from loam to clay loam. The solum is 14 to 20 inches thick. The underlying till ranges from sandy loam to loam.

The Nenno soils are less than 20 inches over till, but the Lamartine soils are 20 to 36 inches over till. In contrast to Nenno soils, the Matherton soils are 24 to 40 inches over stratified sand and gravel.

Nenno silt loam, 1 to 3 percent slopes (NnA).—This soil has a seasonal high water table. The erosion hazard is slight in the more sloping areas of this soil. Where it is adequately drained and properly managed, this soil is well suited to the crops commonly grown in the county. Areas not drained have moderate limitations if used for cultivated crops. (Capability unit IIw–2; woodland group 7; recreation group 4; wildlife group 3)

Otter Series

The Otter series consists of nearly level soils that formed in silty alluvium more than 20 inches thick. These soils of the lowlands are poorly drained.

In a typical profile the surface layer is mildly alkaline, very dark brown silt loam about 11 inches thick. Below this is about 29 inches of mildly alkaline, black to very dark gray silt loam that feels gritty. The substratum is calcareous, light-gray loam.

These soils can hold more than 12 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderately slow, internal drainage is very slow, and natural fertility is high.

In some places, especially along streams and drainageways, on foot slopes, and in small depressions, adequately drained areas of these soils are used for corn, small grains, legumes, and other common crops. Many of the undrained areas are used for pasture, trees, or wildlife.

Typical profile of Otter silt loam in an uncultivated area (NE¼NE¼ sec. 20, T. 10 N., R. 20 E.):

A11—0 to 11 inches, very dark brown (10YR 2/2) silt loam; moderate, medium, granular structure; very friable; mildly alkaline; clear, smooth boundary.

A12—11 to 27 inches, black (10YR 2/1) gritty silt loam; moderate, medium, platy to moderate, fine, subangular blocky structure; friable; mildly alkaline; clear, smooth boundary.

A13—27 to 40 inches, very dark gray (10YR 3/1) gritty silt loam; moderate, medium, platy to moderate, fine, subangular blocky structure; friable; mildly alkaline; clear, smooth boundary.

IIC—40 to 60 inches +, light-gray (10YR 5/2) loam; massive; firm; calcareous.

The A horizon ranges from 24 to more than 60 inches in thickness. In many places thin layers of fine sand to medium sand are below a depth of 30 inches.

Otter soils are deeper and are darker colored than the Pella soils, which are silty and have gleyed horizons below a depth of about 11 inches.

Otter silt loam (0 to 2 percent slopes) (Ot).—This soil occurs on lowlands and is subject to frequent flooding from adjacent streams. Where drained and properly managed, this soil is well suited to the crops commonly grown in the county. Areas not drained have severe limitations if used for cultivated crops. (Capability unit IIw–1; woodland group 9; recreation group 3; wildlife group 5)

Ozaukee Series

The Ozaukee series consists of gently sloping to very steep soils that formed in calcareous silty clay loam till. These soils of the uplands are well drained.

In a typical profile the surface layer is mildly alkaline, dark grayish-brown silt loam about 8 inches thick. Below this is about 4 inches of mildly alkaline, brown silt loam.

The subsoil is mildly alkaline and about 15 inches thick. The upper part is brown silty clay loam, and the lower part is reddish-brown silty clay.

The substratum is calcareous, brown silty clay loam glacial till.

This soil can hold about 11 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderately slow, internal drainage is medium, and natural fertility is moderate.

Most of the nearly level to gently sloping areas are used for corn, small grains, legumes, and other cultivated crops that are common in the county. The steeper areas are mostly in pasture or trees.

Typical profile of Ozaukee silt loam, 2 to 6 percent slopes, in a cultivated area (SE¼SE¼ sec. 13, T. 9 N., R. 20 E.):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; very friable; mildly alkaline; abrupt, smooth boundary.

A3—8 to 12 inches, brown (7.5YR 5/4) silt loam; moderate, medium, subangular blocky structure; friable; mildly alkaline; abrupt, smooth boundary.

B21t—12 to 17 inches, dark-brown (7.5YR 4/4) silty clay loam; moderate, medium, subangular blocky structure; friable; thin, patchy clay films; mildly alkaline; gradual, smooth boundary.

B22t—17 to 27 inches, reddish-brown (5YR 4/3) silty clay; strong, medium, angular blocky structure; firm; continuous clay films on the ped faces; mildly alkaline; gradual, smooth boundary.

C—27 to 60 inches +, brown (7.5YR 5/4) silty clay loam; moderate, coarse, angular blocky structure; firm; calcareous.

The Ap horizon ranges from 7 to 9 inches in thickness. Undisturbed areas generally have a very dark gray (10YR 3/1) A1 horizon less than 5 inches thick. The solum ranges from 20 to 30 inches in thickness. In places these soils are mantled with silt less than 12 inches thick.

Ozaukee soils are more gritty and have more pebbles in the solum than the Saylesville soils, which formed in lake-laid silt and clay. In contrast to Ozaukee soils, the Hochheim soils formed in calcareous till of loam and sandy loam texture.

Ozaukee silt loam, 2 to 6 percent slopes (OuB).—During wet seasons water seeps laterally in this soil at a depth below 24 inches. This soil has the profile described as typical for the series. In Barton, Germantown, Polk, and West Bend Townships, areas of this soil are underlain by loam and silt loam till. This soil occurs on uplands

and is susceptible to erosion, which thins the surface layer and reduces fertility. Small areas of soils that have a very dark grayish-brown surface layer are included in mapping.

This soil has moderate limitations if cultivated intensively. Management is needed for protection against erosion, but crops grow well if management is good. (Capability unit IIe–3; woodland group 2; recreation group 12; wildlife group 1)

Ozaukee silt loam, 2 to 6 percent slopes, eroded (OuB2).—In this soil the surface layer is lighter colored than that described as typical for the series and the thickness of the combined surface layer and subsoil is somewhat less, or about 25 inches. During wet periods, water seeps laterally in this soil at a depth below 24 inches. In Barton, Germantown, Polk, and West Bend Townships, this soil is underlain by loam and silt loam till.

Because this soil of the uplands is suceptible to further erosion, limitations to intensive cultivation are moderate. Tilth is difficult to maintain, but crops grow well if management is good and provides practices to control erosion. (Capability unit IIe–3; woodland group 2; recreation group 12; wildlife group 1)

Ozaukee silt loam, 6 to 12 percent slopes, eroded (OuC2).—In this soil the surface layer is lighter colored than that in the profile described as typical for the series, and the thickness of the combined surface layer and subsoil is somewhat less, or about 24 inches. During wet periods water seeps laterally in this soil at a depth below 24 inches. In Barton, Germantown, Polk, and West Bend Townships, this soil is underlain by loam and silt loam till. Included with this soil in mapping are areas that are severely eroded and areas that are only slightly eroded.

Because this soil of the uplands is susceptible to further erosion, limitations to intensive cultivation are moderately severe. Careful management that helps to control erosion is needed. Eroded areas are difficult to manage and to keep in good tilth. (Capability unit IIIe–3; woodland group 2; recreation group 12; wildlife group 1)

Ozaukee silt loam, 12 to 20 percent slopes, eroded (OuD2).—This soil has a surface layer that is lighter colored than that in the profile described as typical for the series and a combined surface layer and subsoil that is somewhat thinner, or about 22 inches thick. During wet periods, water seeps laterally in this soil at a depth below about 24 inches. In places this soil is hilly and has complex slopes. In Barton, Germantown, Polk, and West Bend Townships, the underlying till is of loam and silt loam texture. Included with this soil in mapping are areas that are severely eroded and areas that are only slightly eroded.

Since this soil of the uplands is steep, it is susceptible to further erosion and has severe limitations if intensively cropped. Because of erosion, good tilth is difficult to maintain. Careful management that provides protection against erosion is needed (fig. 16). (Capability unit IVe–1; woodland group 2; recreation group 12; wildlife group 1)

Ozaukee silt loam, 20 to 35 percent slopes (OuE).—In this soil the thickness of the combined surface layer and subsoil is about 20 inches, or less than in the profile described as typical for the series.

This soil of the uplands is best suited to pasture, as woodland, as wildlife habitat, or as recreational areas. Because runoff is rapid, damage by erosion is severe un-

Figure 16.—**Ozaukee silt loam, 12 to 20 percent slopes, eroded, surrounding a farm pond. To control erosion on this soil, the slopes are seeded to permanent vegetation.**

less areas are protected by a plant cover. (Capability unit VIe–1; woodland group 2; recreation group 12; wildlife group 1)

Palms Series

The Palms series consists of nearly level soils that formed from decaying reeds, grasses, and sedges. These very poorly drained soils are underlain by loamy material at a depth ranging from 12 to 42 inches.

In a typical profile the surface layer, 15 inches thick, is neutral, black mucky peat containing many brown plant remains in the lower part. The next layer, about 13 inches thick, is neutral, black mucky peat that has many to few, decomposed, brown plant fibers. The substratum is mildly alkaline, dark grayish-brown silt loam.

These soils can hold about 11 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, internal drainage is slow, and natural fertility is low.

Some areas of these organic soils are drained and used for corn and other cultivated crops. Most undrained areas are used for pasture, trees, or wildlife.

Typical profile of Palms mucky peat in an uncultivated field (NW¼NW¼ sec. 3, T. 9 N., R. 20 E.):

1—0 to 11 inches, black (N 2/0) mucky peat; weak, fine, granular structure; very friable; neutral; clear, smooth boundary.

2—11 to 15 inches, black (5YR 2/1) mucky peat; moderate, thick, platy structure; friable; many brown (7.5YR 5/4) sedge and grass fibers; neutral; clear, smooth boundary.

3—15 to 28 inches, black (N 2/0) mucky peat; moderate, medium, subangular blocky structure; friable; few brown 7.5YR 5/4) sedge and grass fibers; neutral; abrupt, smooth boundary.

IIC—28 to 60 inches +, dark grayish-brown (2.5Y 4/2) silt loam; massive; firm; mildly alkaline.

In places small woody fragments and less decomposed fibrous materials are in the profile. The substratum ranges from sandy loam to silty clay loam.

Palms soils have finer textured substratum than that of Adrian soils, which are underlain by sandy materials. In contrast to the Palms soils, the Houghton soils formed in organic deposits more than 42 inches deep.

Palms mucky peat (0 to 2 percent slopes) (Pc).—This soil is subject to frequent flooding along streams and around lakes.

Where this soil is drained and properly managed, it is suited to specialty crops and to corn grown for silage. Undrained areas are severely limited if used for cultivated crops. Drained areas are susceptible to soil blowing where a plant cover is not maintained. (Capability unit IIw–4; woodland group 10; recreation group 1; wildlife group 2)

Pella Series

The Pella series consists of nearly level soils that formed in loess more than 36 inches thick over calcareous loamy till. These soils of the lowlands are poorly drained.

In a typical profile the surface layer is mildly alkaline, black silt loam about 11 inches thick.

The subsoil is about 37 inches thick. It is mildly alkaline, gray silty clay loam and heavy silt loam mottled with strong brown to a depth of 24 inches. The next layer is about 8 inches of slightly calcareous, gray silt loam, also mottled with strong brown. Next is weakly calcareous, dark-gray gritty silt loam.

The substratum is calcareous, gray sandy loam.

These soils can hold about 9 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderately slow, internal drainage is very slow, and natural fertility is high.

After these soils are adequately drained, they can be used for corn, small grains, legumes, and other crops commonly grown in the county. Most undrained areas are in pasture or trees.

Typical profile of Pella silt loam in a cultivated field (SE¼SW¼ sec. 20, T. 9 N., R. 18 E.):

Ap—0 to 8 inches, black (10YR 2/1) silt loam; moderate, medium, granular structure; friable; mildly alkaline; abrupt, smooth boundary.

A1—8 to 11 inches, black (10YR 2/1) silt loam; moderate, medium, subangular blocky structure; friable; mildly alkaline; clear, smooth boundary.

B21g—11 to 18 inches, gray (5Y 5/1) silty clay loam; few, fine, distinct mottles of strong brown (7.5YR 5/8); moderate, fine, angular blocky structure; firm; mildly alkaline; clear, smooth boundary.

B22g—18 to 24 inches, gray (5Y 5/1) heavy silt loam; common, fine, distinct mottles of strong brown (7.5YR 5/8); moderate, medium, angular blocky structure; firm; thin, patchy clay films on ped faces; mildly alkaline; clear, smooth boundary.

B31g—24 to 32 inches, gray (5Y 5/1) silt loam; many, coarse, distinct mottles of strong brown (7.5YR 5/8); weak, medium, prismatic to moderate, medium, angular blocky structure; firm; slightly calcareous; clear, smooth boundary.

B32g—32 to 48 inches, dark-gray (5Y 4/1) gritty silt loam; weak, medium, subangular blocky structure; firm; weakly calcareous.

C—48 to 60 inches, gray (5Y 5/1) sandy loam; massive; firm; calcareous.

The A1 or Ap horizon ranges from 10 to 12 inches in thickness, and the solum ranges from 36 to 60 inches. The B2g horizon ranges from silt loam to silty clay loam. The C horizon generally is sandy loam, but in places it has pockets of sand below a depth of 36 inches.

In the Pella soils the silty layer above the till is more than 20 inches thick, but the Brookston soils have 6 to 20 inches of silty soil over till. In contrast to the Pella soils, which are underlain by sandy loam, the Colwood soils are underlain by silt and fine sand.

Pella silt loam (0 to 2 percent slopes) (Ph).—This soil of the lowlands has a high water table and is subject to periodic flooding near streams or lakes. The more sloping areas have better surface drainage than the more nearly level areas. Included with this soil in mapping are areas that have slopes of more than 2 percent and areas where the surface layer is silty clay loam.

Where this soil is drained and properly managed, it is well suited to the crops commonly grown in the county. Undrained areas have severe limitations where used for cultivated crops. (Capability unit IIw–1; woodland group 7; recreation group 3; wildlife group 2)

Radford Series

The Radford series consists of nearly level to gently sloping soils that formed in silty colluvium more than 20 inches thick over older somewhat poorly drained to poorly

drained mineral soils. Radford soils are on lowlands and are somewhat poorly drained.

In a typical profile the surface layer is slightly acid, very dark grayish-brown silt loam about 30 inches thick. Below this is about 17 inches of slightly acid, black silt loam that grades to dark-gray silty clay loam.

The subsoil is about 13 inches thick. It is slightly acid, grayish-brown silty clay loam mottled with yellowish brown and gray to light gray.

These soils can hold about 11 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderately slow, internal drainage is slow, and natural fertility is high.

After these soils are adequately drained, they can be used for corn, small grains, legumes, and other crops commonly grown in the county. Most undrained areas are in pasture or trees.

Typical profile of Radford silt loam, 0 to 3 percent slopes, in an uncultivated area (NE¼SE¼ sec. 15, T. 10 N., R. 19 E.):

A1—0 to 30 inches, very dark grayish-brown (10YR 3/2) silt loam; common, medium, distinct mottles of brown to dark brown (7.5YR 4/2-4/4); moderate, medium, platy structure; very friable; slightly acid; some stratification in which the strata are dark grayish brown (10YR 4/2); clear, smooth boundary.

A1b—30 to 40 inches, black (10YR 2/1) silt loam; weak, medium, blocky structure; very friable; slightly acid; clear, smooth boundary.

A3b—40 to 47 inches, dark-gray (10YR 4/1) silty clay loam; moderate, medium, blocky structure; friable; slightly acid; clear, smooth boundary.

B2g—47 to 60 inches +, grayish-brown (2.5Y 5/2) silty clay loam; many, medium, distinct mottles of yellowish brown (10YR 5/6) and gray to light gray (10YR 6/1); moderate, medium, blocky structure; friable; slightly acid.

The silty colluvium above the A1b horizon ranges from 20 to more than 60 inches. It generally is silty, but thin sandy layers occur in places.

Radford soils have a much thicker, darker surface layer than the Kendall soils, which have a surface layer less than 10 inches thick.

Radford silt loam, 0 to 3 percent slopes (RaA).—This soil occurs along drainageways, and it is subject to erosion caused by runoff from higher areas. Where drained and properly managed, this soil is well suited to the crops commonly grown in the county. Undrained areas have moderate limitations if used for cultivated crops. (Capability unit IIw–2; woodland group 9; recreation group 4; wildlife group 5)

Ritchey Series

The Ritchey series consists of gently sloping to sloping soils that formed in less than 20 inches of loess over dolomite bedrock. These soils of the uplands are well drained.

In a typical profile the surface layer is neutral, brown silt loam about 8 inches thick.

The subsoil is about 6 inches thick. The upper part is neutral, dark-brown gritty silty clay loam. The lower part is calcareous, brown gritty silty clay loam.

The substratum is dolomite bedrock.

These soils can hold about 3 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, internal drainage is medium, and natural fertility is low.

These soils are used mostly for corn, small grains, legumes, and other cultivated crops commonly grown in the county. Most of the steeper areas are in pasture or trees.

Typical profile of Ritchey silt loam, 2 to 6 percent slopes, in a cultivated field (NW¼NW¼ sec. 27, T. 9 N., R. 20 E.):

Ap—0 to 8 inches, brown (10YR 4/3) silt loam; moderate, medium, granular structure; friable; neutral; abrupt, smooth boundary.

B21t—8 to 12 inches, dark-brown (10YR 3/3) gritty silty clay loam; moderate to strong, fine, subangular blocky structure; firm; continuous clay films on the ped surfaces; neutral; abrupt, smooth boundary.

B22t—12 to 14 inches, brown (10YR 4/3) gritty silty clay loam; moderate to strong, very fine, subangular blocky structure; firm; very dark grayish-brown (10YR 3/2) stains of organic matter; calcareous; abrupt, smooth boundary.

R—14 to 60 inches +, dolomite.

The Ap horizon is brown (10YR 4/3) or dark grayish brown (10YR 4/2). In undisturbed areas the A1 horizon generally is very dark gray (10YR 3/1) and less than 5 inches thick. In most places the lower part of the solum formed from fragments of the dolomite bedrock or from glacial till, but in some places the entire solum formed from loess. The solum ranges from 12 to 20 inches in thickness.

Ritchey soils are thinner over bedrock than the Knowles soils, which have more than 20 inches of silty soil over bedrock. The Ritchey soils are underlain by dolomite bedrock, but the Hochheim soils are underlain by loamy till.

Ritchey silt loam, 2 to 6 percent slopes (RkB).—This soil of the uplands has the profile described as typical for the series. Included with this soil in mapping are areas where dolomite bedrock is at or near the surface or soils that have a very dark grayish-brown surface layer.

Because this soil is droughtly and susceptible to erosion, it has moderately severe limitations if cultivated intensively. Erosion control practices are needed because erosion thins the surface layer and reduces fertility. (Capability unit IIIe–2; woodland group 5; recreation group 8; wildlife group 1)

Ritchey silt loam, 6 to 12 percent slopes, eroded (RkC2).—The surface layer of this soil is lighter colored than that of the profile described as typical for the series, and the thickness of the combined surface layer and subsoil is less, or about 12 inches. In some of the steeper areas dolomite bedrock is at or near the surface (fig. 17).

Because this soil is droughty and susceptible to further erosion, it has severe limitations if used for intensive cultivation. Practices that control erosion are needed, for erosion thins the surface layer and reduces fertility. (Capability unit IVe–2; woodland group 5; recreation group 8; wildlife group 1)

Rodman Series

The Rodman series consists of moderately steep to very steep soils that formed in calcareous sand and gravel. These soils of the uplands are excessively drained.

In a typical profile the surface layer is mildly alkaline, very dark brown gravelly sandy loam about 5 inches thick. The subsoil, about 3 inches thick, is weakly calcareous, brown to dark-brown gravelly sandy loam. The

Figure 17.—**Outcrop of dolomite bedrock in an area of Ritchey silt loam, 6 to 12 percent slopes, eroded.**

substratum is calcareous, light yellowish-brown sand and gravel outwash.

These soils can hold about 2 inches of water available to plants between the surface and a depth of 5 feet. Permeability is rapid below the surface layer, internal drainage is very rapid, and natural fertility is very low.

These soils are too shallow or too steep for cultivation. They are best suited to pasture, as woodland, or as wildlife habitat.

In this county Rodman soils are mapped only in complexes with Casco soils.

Typical profile of Rodman gravelly sandy loam that has slopes of 20 to 30 percent, in an undisturbed area (SE¼NE¼ sec. 19, T. 12 N., R. 19 E.):

A1—0 to 5 inches, very dark brown (10YR 2/2) gravelly sandy loam; weak, fine, granular structure; very friable; mildly alkaline; clear, smooth boundary.

B—5 to 8 inches, brown to dark-brown (10YR 4/3) gravelly sandy loam; weak, fine, granular structure; very friable; weakly calcareous; clear, smooth boundary.

C—8 to 60 inches +, light yellowish-brown (10YR 6/4) sand and gravel; single grain; loose; calcareous.

The A1 horizon ranges from 4 to 6 inches in thickness. The substratum ranges from sandy to gravelly and cobbly.

Rodman soils are deeper to bedrock than Casco soils. In contrast to Rodman soils, which formed in sand and gravel, the Hennepin soils formed in loamy till.

Sandy and Gravelly Land

Sandy and gravelly land (Sf) consists of cut and filled areas of sandy and gravelly materials. The filled areas range from 12 inches or less to several feet in thickness. They are underlain by sandy to clayey soils and in some areas by organic soils. The cut, or borrow, areas generally have been graded so that they can be traveled by vehicles or used as building sites. (Capability unit VIIIs–1; woodland group 11; recreation group 13; not placed in a wildlife group)

Saylesville Series

The Saylesville series consists of nearly level to gently sloping soils that formed in calcareous lake-laid silt and clay. These soils of the uplands are well drained.

In a typical profile the surface layer is mildly alkaline, dark grayish-brown silt loam about 9 inches thick. Below this is about 3 inches of mildly alkaline, grayish-brown silt loam.

The subsoil is mildly alkaline and about 14 inches thick. It is brown silty clay loam in the upper part, brown clay in the middle, and brown silty clay in the lower part. Continuous clay films are on the soil aggregates in the subsoil.

The substratum is calcareous, brown to yellowish-brown silty clay loam.

These soils can hold about 10 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderately slow, internal drainage is medium, and natural fertility is high.

Most areas of these soils are used for corn, small grains, legumes, and other crops commonly cultivated in the county. Most of the steeper areas are in pasture or trees.

Typical profile of Saylesville silt loam, 2 to 6 percent slopes, in a cultivated field (SW¼NE¼ sec. 30, T. 9 N., R. 20 E.):

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, subangular blocky to moderate, medium, granular structure; friable; mildly alkaline; abrupt, smooth boundary.

A2—9 to 12 inches, grayish-brown (10YR 5/2) silt loam; moderate, medium, platy structure; friable; mildly alkaline; clear, wavy boundary.

B1—12 to 16 inches, brown (7.5YR 4/2) heavy silty clay loam; moderate, coarse to fine, subangular blocky structure; firm; light grayish-brown (10YR 6/2) silt coatings on the ped faces; mildly alkaline; gradual, irregular boundary.

B2t—16 to 21 inches, brown (7.5YR 4/4) clay; weak, coarse, prismatic breaking to strong, fine, angular and subangular blocky structure; firm; continuous clay films on the ped surfaces and in the pore openings; mildly alkaline; clear, wavy boundary.

B3t—21 to 26 inches, brown (7.5YR 4/2) silty clay; moderate to strong, fine, subangular blocky structure; firm; thin, patchy, dark-brown, highly organic clay films on the ped surfaces; slightly calcareous; clear, wavy boundary.

C—26 to 60 inches +, brown (7.5YR 5/4) to yellowish-brown (10YR 5/4) silty clay loam; moderate, medium, subangular blocky structure; firm; weakly laminated silt and clay; calcareous.

The Ap horizon ranges from 7 to 9 inches in thickness. In undisturbed areas the A1 horizon generally is very dark gray (10YR 3/1) and less than 5 inches thick. The solum ranges from 20 to 30 inches in thickness.

Saylesville soils contain fewer pebbles and are less gritty than the Ozaukee soils, which formed in calcareous silty clay loam till. Saylesville soils formed in lake-laid silt and clay, but Sisson soils formed in lake-laid silt and fine sand.

Saylesville silt loam, 0 to 2 percent slopes (ShA).—The combined surface layer and subsoil of this soil is about 30 inches thick, or thicker than in the profile described as typical for the series. In places soils that have a very dark grayish-brown surface layer are included in mapping.

This soil occurs on uplands and has few limitations for intensive cultivation, but unprotected areas are damaged by erosion, which thins the surface layer and lowers the fertility. If management is good and controls erosion, crops grow well. (Capability unit IIs–2; woodland group 2; recreation group 12; wildlife group 1)

Saylesville silt loam, 2 to 6 percent slopes (ShB).—This soil of the uplands is susceptible to erosion, which thins the surface layer and lowers fertility.

If it is cultivated intensively, this soil has moderate limitations. Management, particularly in bare areas, is needed to control erosion. Crops grow well if management is good. (Capability unit IIe–3; woodland group 2; recreation group 12; wildlife group 1)

Sebewa Series

In the Sebewa series are nearly level, poorly drained soils that formed in 24 to 40 inches of loamy soil over stratified sand and gravel. These soils of the lowlands are poorly drained.

In a typical profile the surface layer is mildly alkaline, black silt loam about 10 inches thick. Below this is about 2 inches of mildly alkaline, dark-gray loam.

The subsoil is about 14 inches thick. The upper part is neutral, gray silty clay loam mottled with strong brown. The lower part is mildly alkaline, gray loam also mottled with strong brown.

The substratum is calcareous, light-gray, stratified sand and gravel.

These soils can hold about 5 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, internal drainage is very slow, and natural fertility is moderate.

After these soils on lowlands are adequately drained, they can be used for the crops commonly cultivated in the county, such as corn, small grains, and legumes. Most undrained areas are in pasture or trees.

Typical profile of Sebewa silt loam (0 to 2 percent slopes) in a cultivated field (NW¼SW¼ sec. 1, T. 10 N., R. 19 E.):

Ap—0 to 10 inches, black (10YR 2/1) silt loam; moderate, medium, granular structure; very friable; mildly alkaline; abrupt, smooth boundary.

A3g—10 to 12 inches, dark-gray (10YR 4/1) loam; weak, medium, platy structure; very friable; mildly alkaline; clear, smooth boundary.

B2tg—12 to 21 inches, gray (5Y 5/1) silty clay loam; few, fine, distinct mottles of strong brown (7.5YR 5/6); strong, medium, angular blocky structure; firm; patchy clay films on ped faces; neutral; clear, smooth boundary.

B3g—21 to 26 inches, gray (5Y 5/1) loam; few, fine, distinct, mottles of strong brown (7.5YR 5/6); moderate, coarse, angular blocky structure; friable; mildly alkaline; clear, smooth boundary.

C—26 to 60 inches +, light-gray (10YR 7/2), stratified sand and gravel; single grain; loose; calcareous.

The A1 or Ap horizon ranges from 8 to 11 inches in thickness. The B2 horizon ranges from silt loam to silty clay loam. The C horizon is sandy or gravelly and in some places has thin layers of silt.

Sebewa soils are deeper to the substratum than the Mussey soils, which have 12 to 24 inches of loamy material over sand and gravel. In contrast to the Sebewa soils, the Drummer soils formed in more than 40 inches of loamy materials over sand and gravel.

Sebewa silt loam (0 to 2 percent slopes) (Sm).—This soil has a high water table and is subject to flooding along streams and around lakes. Included with this soil in mapping are areas that have a loam surface layer. Also included are areas that have slopes of more than 2 percent.

In areas that are well drained and properly managed, this soil of the lowlands is well suited to commonly grown crops. In undrained areas, it has severe limitations to use for cultivated crops. (Capability unit IIw–3; woodland group 7; recreation group 3; wildlife group 2)

Sisson Series

The Sisson series consists of nearly level to gently sloping soils that formed from lake-laid silt and fine sand. These soils of the uplands are well drained.

In a typical profile the surface layer is mildly alkaline, dark grayish-brown fine sandy loam about 9 inches thick. Below this is about 5 inches of mildly alkaline, brown fine sandy loam.

The subsoil is mildly alkaline and about 12 inches thick. It is brown loam in the upper part, brown clay loam in the middle part, and strong-brown sandy loam in the lower part.

The substratum is calcareous, brownish-yellow very fine sandy loam.

These soils can hold about 9 inches of water available to plants between the surface and a depth of about 5 feet. Permeability is moderate, internal drainage is medium, and natural fertility is moderate.

Most areas of these soils are used for corn, small grains, legumes, and other crops commonly cultivated in the county. Most of the steeper areas are in pasture or trees.

Typical profile of Sisson fine sandy loam, 2 to 6 percent slopes, in a cultivated field (SE¼SE¼ sec. 1, T. 11 N., R. 19 E.):

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, medium, granular structure; very friable; mildly alkaline; abrupt, smooth boundary.

A2—9 to 14 inches, brown (10YR 4/3) fine sandy loam; weak, medium, subangular blocky structure; friable; mildly alkaline; clear, smooth boundary.

B1t—14 to 17 inches, brown (7.5YR 4/4) loam; moderate, medium, angular blocky structure; thin, patchy clay films; friable; mildly alkaline; clear, smooth boundary.

B2t—17 to 24 inches, brown (7.5YR 4/4) clay loam; moderate, medium, angular blocky structure; firm; continuous clay films on ped surfaces; mildly alkaline; clear, wavy boundary.

B3—24 to 26 inches, strong-brown (7.5YR 5/6) sandy loam; weak, medium, subangular blocky structure; friable; mildly alkaline; clear, wavy boundary.

C—26 to 60 inches +, brownish-yellow (10YR 6/6) very fine sandy loam; weak, thick, platy structure; friable; calcareous.

The Ap horizon ranges from 7 to 9 inches in thickness. In undisturbed areas the A1 horizon generally is very dark gray (10YR 3/1) and less than 4 inches thick. The solum ranges from 20 to 36 inches in thickness. The C horizon ranges from fine sand to silt.

Sisson soils are finer in the C horizon than the Fox soils, which are loamy soils that are 24 to 40 inches thick over sand and gravel. In contrast to the Sisson soils, which formed in lake-laid silt and fine sand, the Hochheim soils formed in loamy till.

Sisson fine sandy loam, 2 to 6 percent slopes (SrB).—This soil has the profile described as typical for the series. Some areas are undulating and have complex slopes. Included in mapping are soils that have a very dark grayish-brown surface layer.

This soil of the uplands is susceptible to erosion and has moderate limitations if used for intensive cultivation. Unless practices that protect this soil are followed, erosion thins the surface layer and lowers fertility and the content of organic matter. If management is good, crops grow well. (Capability unit IIe–2; woodland group 3; recreation group 7; wildlife group 1)

Sisson fine sandy loam, 6 to 12 percent slopes, eroded (SrC2).—The combined surface layer and subsoil of this soil is about 22 inches thick, or somewhat thinner than in the profile described as typical for the series. Also, the surface layer is lighter colored than that in the typical profile. Included with this soil in mapping are some severely eroded areas.

This soil of the uplands is susceptible to soil blowing and water erosion and has a moderately severe limitation if used for intensive cultivation. Unless practices that protect this soil are used, erosion thins the surface layer and lowers the fertility. (Capability unit IIIe–2; woodland group 3; recreation group 7; wildlife group 1)

Sisson fine sandy loam, 12 to 20 percent slopes, eroded (SrD2).—The surface layer of this soil is lighter colored than that in the profile described as typical for the series. Also, the thickness of the combined surface layer and subsoil is about 20 inches, or less than that in the typical profile.

Included with this soil in mapping are some areas that have a silt loam surface layer and, in pasture or woodland, areas that are only slightly eroded.

This soil of the uplands is susceptible to further erosion, and it is severely limited if used for intensive cultivation. Practices are needed that protect this soil against erosion, which thins the surface layer and lowers fertility. (Capability unit IVe–1; woodland group 3; recreation group 7; wildlife group 1)

Sisson-Casco-Hochheim complex, 0 to 2 percent slopes (SvA).—This complex consists of Sisson, Casco, and Hochheim soils that formed in as much as 20 inches of loess over closely intermingled lake-laid silt and fine sand, loose sand and gravel, and loamy till. These soils are too closely associated to be mapped separately.

This complex is about 40 percent Sisson soils, 25 percent Casco soils, 25 percent Hochheim soils, and 10 percent included soils.

In this complex the Sisson, Casco, and Hochheim soils have a combined surface layer and subsoil that is thicker than corresponding layers in the profiles described as typical for their respective series. In most places the surface layer of the Sisson soils is loam or silt loam. The Casco and the Hochheim soils have a silt loam surface layer.

These soils of the uplands have few limitations if used for farming, and they are well suited to intensive cultivation. Crops grow well if management is good. (Capability unit I–1; woodland group 1; recreation group 7; wildlife group 1)

Sisson-Casco-Hochheim complex, 2 to 6 percent slopes, eroded (SvB2).—In this complex are Sisson, Casco, and Hochheim soils, which formed in as much as 20 inches of loess over a mixture of lake-laid silt and fine sand, loose sand and gravel, and loamy glacial till. Included in mapping are some areas of pasture and woodland that are only slightly eroded.

About 40 percent of the acreage is Sisson soils, about 25 percent is Casco soils, about 25 percent is Hochheim soils, and about 10 percent is included soils.

The Sisson, Casco, and Hochheim soils have a lighter colored surface layer than that in the profile described as typical for their respective series. The surface layer of the Sisson soils is silt loam instead of the fine sandy loam described as typical. In places the surface layer of the Casco soils is silt loam instead of the typical loam. In places Hochheim soils have a loam surface layer instead of the silt loam described as typical. They also have a thicker combined surface layer and subsoil than that described.

These soils on uplands are susceptible to further erosion and have moderate limitations if used for intensive cultivation. Practices that protect bare areas are needed to control erosion, which thins the surface layer and lowers the fertility. If management is good, crops grow well. (Capability unit IIe–1; woodland group 1; recreation group 7; wildlife group 1)

Sisson-Casco-Hochheim complex, 6 to 12 percent slopes, eroded (SvC2).—The Sisson, Casco, and Hochheim soils in this complex formed in as much as 20 inches of loess over closely intermingled lake-laid silt and fine sand, loose sand and gravel, and loamy glacial till. Included in mapping are areas in pasture and trees that are only slightly eroded.

This complex is about 30 percent Sisson soils, 30 percent Casco soils, 30 percent Hochheim soils, and 10 percent other included soils.

The Sisson, Casco, and Hochheim soils have a lighter colored surface layer than that in the profile described as typical for their respective series, and the Sisson and

Casco soils have a thinner combined surface layer and subsoil. In many places the surface layer of the Hochheim soil is loam and coarser textured than that described as typical.

These soils of the uplands are susceptible to further erosion and have moderately severe limitations if used for intensive cultivation. If the soils are left unprotected, erosion is likely to thin the surface layer and lower fertility. Crops grow well if management is good and includes practices that control erosion. (Capability unit IIIe–1; woodland group 1; recreation group 7; wildlife group 1)

Sisson-Casco-Hochheim complex, 12 to 20 percent slopes, eroded (SvD2).—In this complex are Sisson, Casco, and Hochheim soils that formed in as much as 18 inches of loess over closely intermingled lake-laid silt and fine sand, loose sand and gravel, and loamy glacial till. Included areas in pasture and trees are only slightly eroded.

This complex is about 30 percent Sisson soils, 30 percent Casco soils, 30 percent Hochheim soils, and 10 percent other included soils.

The Sisson, Casco, and Hochheim soils have a lighter colored surface layer than in the profile described as typical for their respective series, and a thinner combined surface layer and subsoil. The surface layer of the Sisson soils is loam to silt loam instead of the fine sandy loam described as typical. The Hochheim soils have a loam surface layer instead of the typical silt loam.

Because these soils of the uplands are susceptible to further erosion, they have severe limitations if used for intensive cultivation. If these soils are left unprotected, erosion thins the surface layer and lowers fertility. Crops grow well if management is good and includes practices that control erosion. (Capability unit IVe–1; woodland group 1; recreation group 7; wildlife group 1)

Sisson-Casco-Hochheim complex, 20 to 30 percent slopes (SvE).—This complex consists of Sisson, Casco, and Hochheim soils that formed in as much as 18 inches of loess over closely intermingled lake-laid silt and fine sand, loose sand and gravel, and loamy glacial till (fig. 18). Included with these soils in mapping are areas of Rodman and Hennepin soils.

This complex is about 30 percent Sisson soils, 30 percent Casco soils, 30 percent Hochheim soils, and 10 percent other included soils.

The Sisson, Casco, and Hochheim soils have a combined surface layer and subsoil that is thinner than corresponding layers in the profile described as typical for their respective series. In places the surface layer of Sisson soils is loam instead of the fine sandy loam described as typical. In many places the Casco soils grade to the included Rodman soils. The Hochheim soils have a coarser textured surface layer than that described as typical because, in many places, Hochheim soils grade to the included coarser textured Hennepin soils.

The soils in this complex are well suited to pasture, as woodland, as wildlife habitat, or for recreation. Unless protected by a plant cover, areas are eroded and gullied. Careful management that provides protective cover is

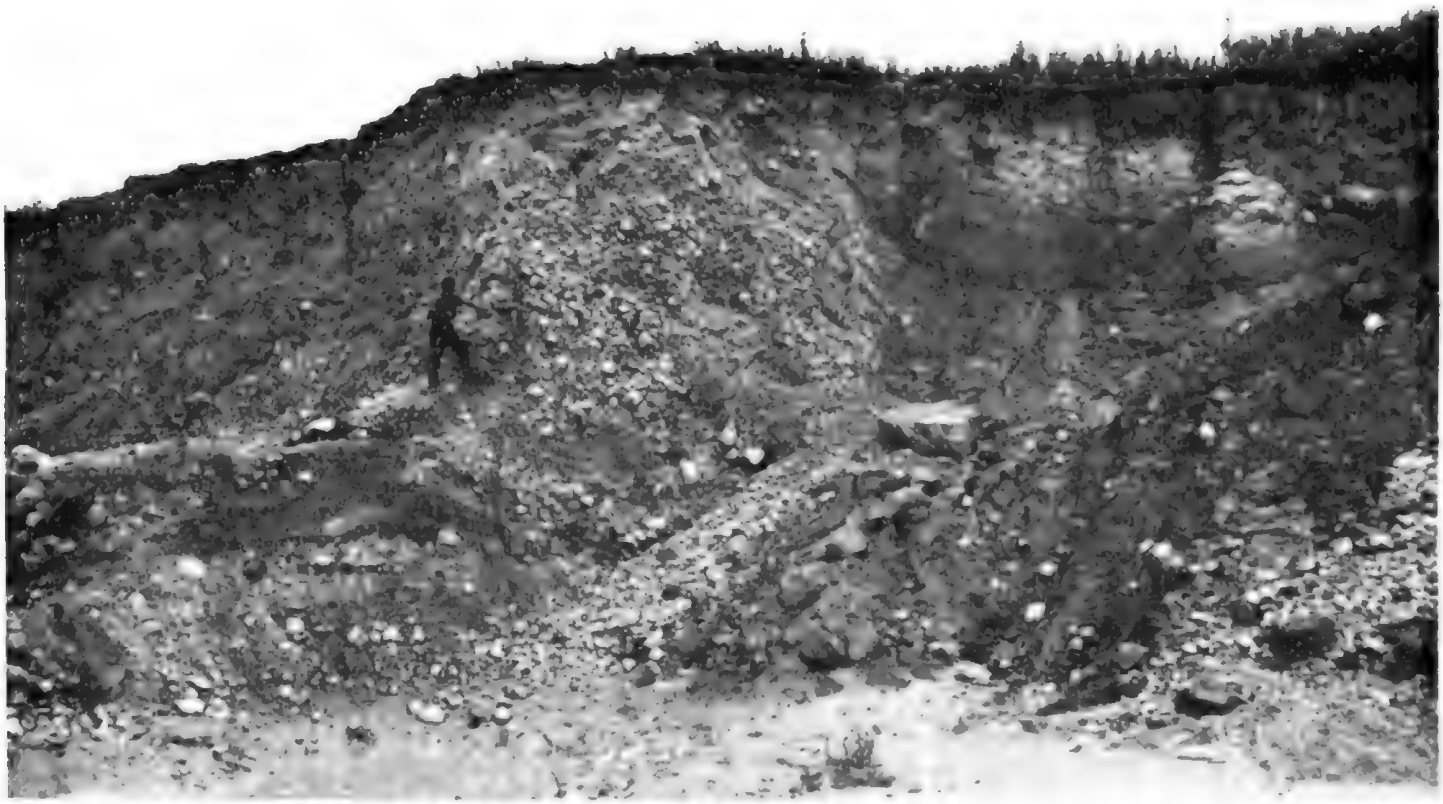

Figure 18.—Loess, 12 to 18 inches thick, over closely intermingled glacial till, outwash sand and gravel, and lake-laid silt and fine sand. These soils are in the Sisson-Casco-Hochheim complex, 20 to 30 percent slopes.

needed. (Capability unit VIe–1; woodland group 1; recreation group 7; wildlife group 1)

St. Charles Series

Soils of the St. Charles series are nearly level to gently sloping and formed in more than 36 inches of silty soil that is generally underlain by calcareous loamy till. In most places in Washington County, the St. Charles soils are mottled in the lower part of the subsoil. In some places the silty soil is underlain by sand and gravel deposited by water. These soils of the uplands are well drained and moderately well drained.

In a typical profile the surface layer is neutral, dark grayish-brown silt loam about 8 inches thick. Below this is about an inch of neutral, light brownish-gray silt loam.

The subsoil is about 43 inches thick. The upper part is slightly acid, brown heavy silt loam. The middle part is medium acid to strongly acid, brown and yellowish-brown silty clay loam. The lower part is strongly acid to neutral, brown and yellowish-brown silt loam. The middle and lower parts of the subsoil have brownish mottles.

The substratum is calcareous, yellowish-brown loam glacial till that is mottled with yellowish brown.

These soils can hold about 10 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, internal drainage is medium, and natural fertility is high. Crop response to additions of a complete fertilizer is good.

These soils are used mostly for cultivated crops, such as corn, small grains, and legumes.

Typical profiles of St. Charles silt loam, 0 to 2 percent slopes, in a cultivated field (SW¼SW¼ sec. 32, T. 11 N., R. 18 E.):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, subangular blocky structure; friable; neutral; abrupt, smooth boundary.

A2—8 to 9 inches, light brownish-gray (10YR 6/2) silt loam; moderate, medium, granular to moderate, medium, platy structure; friable; neutral; clear, wavy boundary.

B1—9 to 13 inches, brown (10YR 4/3) heavy silt loam; moderate, medium, subangular blocky structure; friable; many, light brownish-gray (10YR 6/2) silica coatings; slightly acid; clear, wavy boundary.

B21t—13 to 20 inches, brown (10YR 4/3) silty clay loam; few, fine, distinct mottles of yellowish brown (10YR 5/6); moderate, medium, subangular blocky structure; firm; many, light brownish-gray (10YR 6/2) silica coatings; few, thin, patchy clay films on ped surfaces; medium acid; clear, wavy boundary.

B22t—20 to 30 inches, yellowish-brown (10YR 5/4) light silty clay loam; many, medium, distinct mottles of strong brown (7.5YR 5/6 and 5/8) and brown (7.5YR 4/4); moderate, medium, subangular blocky structure; firm; few, thin, patchy clay films on ped surfaces; strongly acid; clear, wavy boundary.

B31—30 to 41 inches, brown (10YR 5/3) heavy silt loam; many, fine, distinct mottles of yellowish brown (10YR 5/6 and 5/8), grayish brown (10YR 5/2), and light grayish brown (10YR 6/2); weak to moderate, medium, subangular blocky structure; firm; strongly acid; gradual, irregular boundary.

I-IIB32—41 to 60 inches, yellowish-brown (10YR 5/4) gritty silt loam; many, fine, distinct mottles of yellowish brown (10YR 5/6 and 5/8), grayish brown (10YR 5/2), and light grayish brown (10YR 6/2); weak, moderate, subangular blocky structure; firm; neutral; clear, wavy boundary.

IIc—60 inches +, yellowish-brown (10YR 5/4) loam; few, fine, distinct mottles of yellowish brown (10YR 5/6); weak, medium, subangular blocky structure; firm; calcareous.

The Ap horizon ranges from 7 to 9 inches in thickness. In undisturbed areas the A1 horizon is generally very dark gray (10YR 3/1) and less than 5 inches thick. The solum ranges from 42 to 60 inches in thickness. The underlying till ranges from sandy loam to loam in texture and in places has pockets of stratified sand and gravel.

St. Charles soils are deeper to loamy till than the Mayville soils, which have a silty layer less than 36 inches thick over loamy till.

St. Charles silt loam, 0 to 2 percent slopes (ScA).—This soil of the uplands receives concentrated runoff from adjacent slopes in some places. It has the profile described as typical for the series. Included in mapping with this soil are soils that have a very dark grayish-brown surface layer.

This soil has few limitations if used for intensive cultivation. Where management is good, crops grow well. (Capability unit I–1; woodland group 1; recreation group 7; wildlife group 1)

St. Charles silt loam, 2 to 6 percent slopes (ScB).—The thickness of the combined surface layer and subsoil of this soil is about 6 inches less than that in the profile described as typical for the series. Unprotected areas are likely to be damaged by erosion, which thins the surface layer and reduces fertility.

This soil of the uplands has moderate limitations if used for intensive cultivation. Crops grow well if management is good and provides practices for controlling erosion. (Capability unit IIe–1; woodland group 1; recreation group 7; wildlife group 1)

St. Charles silt loam, gravelly substratum, 0 to 2 percent slopes (SeA).—This soil of the uplands has a profile similar to the one described as typical for the series, except that this soil has a gravelly substratum. Some areas are mottled below a depth of 24 inches. Limitations to use for intensive cultivation are few. Crops grow well if management is good. (Capability unit I–1; woodland group 1; recreation group 2; wildlife group 1)

St. Charles silt loam, gravelly substratum, 2 to 6 percent slopes (SeB).—In this soil the thickness of the combined surface layer and subsoil is about 45 inches, or less than that in the profile described as typical for the series. Unprotected areas are damaged by erosion, which thins the surface layer and lowers fertility.

This soil has moderate limitations if used for intensive cultivation. Crops grow well where management is good. (Capability unit IIe–1; woodland group 1; recreation group 2; wildlife group 1)

Theresa Series

The Theresa series consists of nearly level to moderately steep soils that formed in 12 to 20 inches of loess over calcareous gravelly loamy till. These soils of the uplands are well drained.

In a typical profile the surface layer is mildly alkaline, very dark gray silt loam about 3 inches thick. Below this is about 12 inches of mildly alkaline, dark grayish-brown to brown silt loam.

Figure 19.—**Profile of Theresa silt loam, 2 to 6 percent slopes.**

The subsoil is neutral, brown, and about 13 inches thick. The upper part is silt loam, the middle part is silty clay loam, and the lower part is clay loam that has continuous clay films on the soil aggregates, or peds.

The substratum is calcareous, yellowish-brown gravelly loam glacial till.

These soils can hold about 10 inches of water available to plants from the surface to a depth of 5 feet. Permeability is moderate, internal drainage is medium, and natural fertility is moderate.

In most places the nearly level to gently sloping Theresa soils are in cultivated crops that are common in the county, such as corn, small grains, and legumes. The steeper areas are mostly in pasture or trees.

Typical profile of Theresa silt loam, 2 to 6 percent slopes, in an uncultivated area (NW¼NE¼ sec. 23, T. 11 N., R. 19 E.):

A1—0 to 3 inches, very dark gray (10YR 3/1) silt loam; moderate, medium, granular structure; friable; mildly alkaline; clear, smooth boundary.

A2—3 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, platy structure; friable; mildly alkaline; clear, wavy boundary.

A3—10 to 15 inches, brown (10YR 4/3) silt loam; weak, medium, platy structure; friable; mildly alkaline; clear, wavy boundary.

B1—15 to 18 inches, brown (7.5YR 4/4) silt loam; patchy, light-gray (10YR 7/2) silt coatings; moderate, medium, subangular blocky structure; firm; neutral; clear, wavy boundary.

B21t—18 to 25 inches, brown (7.5YR 4/4) gritty silty clay loam; moderate, medium, subangular blocky structure; firm; continuous clay films on the ped surfaces; neutral; clear, wavy boundary.

IIB22t—25 to 28 inches, brown (7.5YR 4/4) clay loam; moderate, medium, subangular blocky structure; firm; continuous, dark-brown (7.5YR 3/2) clay films on the ped surfaces; neutral; clear, wavy boundary.

IIC—28 to 60 inches +, yellowish-brown (10YR 5/4) gravelly loam; massive; friable; calcareous.

The Ap horizon ranges from 7 to 9 inches in thickness. In undisturbed areas, the A1 horizon generally is very dark gray (10YR 3/1) and 2 to 5 inches thick. The solum ranges from 24 to 40 inches in thickness. The underlying till ranges from sandy loam to loam in texture and from 10YR to 7.5YR in hue. In places the substratum is very cobbly or contains pockets of stratified sand and gravel.

The Theresa soils formed in 12 to 20 inches of loess over loamy till, but the loess in Hochheim soils is not more than 12 inches thick over loamy till. In contrast to the Theresa soils, the Fox soils formed in 24 to 40 inches of medium-textured materials over stratified sand and gravel.

Theresa silt loam, 0 to 2 percent slopes (ThA).—In this soil the thickness of the combined surface layer and subsoil is about 30 inches, or about 2 inches more than in the profile described as typical for the series. In some areas in Germantown Township, this soil is underlain by silt loam or silty clay loam till instead of loam till. Also, this Theresa soil grades toward Dodge soils in some areas. Areas of soils that have a very dark grayish-brown surface layer are included.

This soil of the uplands has few limitations if used for intensive cultivation. If management is good, crops grow well. (Capability unit I–1; woodland group 1; recreation group 2; wildlife group 1)

Theresa silt loam, 2 to 6 percent slopes (ThB).—This soil has the profile described as typical for the series (fig. 19). In Germantown Township some areas of this soil are underlain by till that is silt loam or silty clay loam instead of loam till. Many places in Erin Township have loose sand and gravel under the loamy till at a depth of 5 to 10 feet or more. Some areas of this soil are undulating and have complex slopes. In most places this soil has concave slopes of 2 to 3 percent.

This soil of the uplands is susceptible to erosion and has moderate limitations if used for intensive cultivation. If this soil is left unprotected, erosion is likely to thin the surface layer and lower fertility (fig. 20). If management is good, crops grow well. (Capability unit IIe–1; woodland group 1; recreation group 2; wildlife group 1)

Theresa silt loam, 2 to 6 percent slopes, eroded (ThB2).—This soil has a profile similar to that described as typical for the series except that it has a lighter colored surface layer. In places this soil is undulating and has

Figure 20.—Alfalfa growing on Theresa silt loam, 2 to 6 percent slopes. Contour stripcropping is used to help control erosion.

complex slopes. In most places slopes are 4 to 5 percent. In some areas this soil grades toward the Hochheim soils.

In part of Germantown Township this soil is underlain by silt loam or silty clay loam till. In and near Erin Township many areas have loose sand and gravel under the loamy till at a depth of 5 to 10 feet or more (fig. 21).

This soil of the uplands is susceptible to further erosion and has moderate limitations if used for intensive cultivation. If this soil is left unprotected, erosion thins the surface layer and lowers the fertility. Where management is good, crops grow well. (Capability unit IIe–1; woodland group 1; recreation group 2; wildlife group 1)

Theresa silt loam, 6 to 12 percent slopes, eroded (ThC2).—This soil has a profile similar to the one described as typical for the series except that the surface layer is lighter colored and the thickness of the combined surface layer and subsoil is 26 inches instead of 28. Included in mapping are some areas in pasture or woodland that are only slightly eroded.

Because this soil of the uplands is susceptible to further erosion, it has moderately severe limitations if used for intensive cultivation. If this soil is left unprotected, erosion thins the surface layer and lowers fertility. (Capability unit IIIe–1; woodland group 1; recreation group 2; wildlife group 1)

Virgil Series

The Virgil series consists of nearly level, somewhat poorly drained soils that formed in more than 40 inches of loamy materials. In Washington County these soils are underlain by calcareous stratified sand and gravel.

In a typical profile the surface layer is mildly alkaline, very dark grayish-brown silt loam about 9 inches thick.

The subsoil is about 41 inches thick. The upper part is mildly alkaline, dark-brown to brown heavy silt loam mottled with strong brown and dark grayish brown. The middle part is neutral, grayish-brown silty clay loam mottled with dark gray to very dark gray and strong brown. The lower part is weakly calcareous, yellowish-brown sandy loam mottled with strong brown.

The substratum is calcareous, light yellowish-brown sandy outwash.

These soils can hold about 9 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, and internal drainage is slow. Natural fertility is high. Crop response to additions of a complete fertilizer is good.

If these soils are adequately drained, they can be used for corn, small grains, legumes, and other cultivated crops commonly grown in the county. Many of the undrained areas are in pasture or trees.

Figure 21.—**Loamy glacial till 5 to 15 feet thick underlain by loose sand and gravel in a gravel pit. The soil is Theresa silt loam, 2 to 6 percent slopes, eroded.**

Typical profile of Virgil silt loam, gravelly substratum, 0 to 3 percent slopes, in a cultivated field (NE¼NE¼ sec. 28, T. 9 N., R. 20 E.):

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium, granular structure; very friable; mildly alkaline; abrupt, smooth boundary.

B1—9 to 17 inches, dark-brown to brown (10YR 4/3) heavy silt loam; common, fine, distinct mottles of strong brown (7.5YR 5/6) and dark grayish brown (10YR 4/2); moderate, medium, angular blocky structure; friable; mildly alkaline; clear, smooth boundary.

B2t—17 to 48 inches, grayish-brown (10YR 5/3) silty clay loam; many, medium, distinct mottles of strong brown (7.5YR 5/6) and few, fine, distinct mottles of dark gray (10YR 4/1) to very dark gray (10YR 3/1); moderate, medium, angular blocky structure; friable; continuous clay films on the ped surfaces; neutral; clear, wavy boundary.

B3—48 to 50 inches, yellowish-brown (10YR 5/4) sandy loam; many, medium, distinct mottles of strong brown (7.5YR 5/6); weak, medium, subangular blocky structure; very friable; weakly calcareous; clear, smooth boundary.

C—50 to 60 inches +, light yellowish-brown (10YR 6/4), medium and fine sand and gravel; single grain; loose; calcareous.

The Ap horizon ranges from 7 to 9 inches in thickness. In undisturbed areas the A1 horizon generally is very dark gray (10YR 3/1) and is less than 6 inches thick. The solum ranges from 40 to 60 inches or more in thickness. The substratum is sandy or gravelly.

In this county the Virgil soils are deeper to loamy materials than Matherton soils, which have 24 to 40 inches of loamy materials over sand and gravel. In contrast to the Virgil soils, the Lamartine soils formed in 18 to 36 inches of loess over loamy till.

Virgil silt loam, gravelly substratum, 0 to 3 percent slopes (VsA).—This soil has a seasonal high water table and is subject to periodic flooding. The erosion hazard is slight in the more sloping areas. Small areas of a soil

that has a dark grayish-brown surface layer are included.

If this soil is drained and properly managed, it is well suited to the crops commonly grown in the county. Undrained areas have moderate limitations if used for cultivated crops. (Capability unit IIw–3; woodland group 7; recreation group 4; wildlife group 3)

Wallkill Series

The Wallkill series consists of nearly level to gently sloping soils that formed in 20 to 40 inches of silty alluvium or colluvium over organic deposits. These soils are poorly drained.

In a typical profile the surface layer is neutral, black silt loam about 22 inches thick. The upper part of the substratum is neutral black peaty muck, and the lower part is neutral black mucky peat that contains dark reddish-brown plant fibers.

These soils can hold about 13 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, internal drainage is very slow, and natural fertility is high.

If these soils are drained, some areas, especially those along streams and drainageways, on foot slopes, and in small depressions in the lowlands can be used for corn, small grains, legumes, and other crops common in the county. Most of the undrained areas are used for pasture, as woodland, or as wildlife habitat.

Typical profile of Wallkill silt loam in an uncultivated area (SW¼NW¼ sec. 5, T. 11 N., R. 18 E.):

A1—0 to 22 inches, black (10YR 2/1) silt loam; moderate, medium, granular structure; very friable; few, fine, dark yellowish-brown (10YR 3/4) root fragments; neutral; clear, smooth boundary.

II1—22 to 31 inches, black (5YR 5/1) peaty muck; moderate, medium, granular structure; very friable; neutral; clear, smooth boundary.

II2—31 to 60 inches +, black (5YR 5/1) mucky peat; moderate, medium, platy structure; very friable; many, fine, dark reddish-brown (5YR 3/4) fibers of sedge and wood; neutral.

The alluvial or colluvial deposits generally are silty, but in places thin sandy layers occur within the silty materials.

Wallkill soils are underlain by organic deposits, but the Radford soils are underlain by mineral soil. In contrast to Wallkill soils, the Houghton soils formed entirely in deep organic-matter deposits more than 42 inches thick.

Wallkill silt loam (Wo).—This soil has a high water table and is subject to flooding. Slopes range from 0 to 3 percent, but included in mapping are some areas that have slopes of more than 3 percent. If this soil of the lowlands is drained and properly managed, it is well suited to the crops commonly grown in the county. Undrained areas have severe limitations if used for cultivated crops. (Capability unit IIw–4; woodland group 10; recreation group 10; wildlife group 5)

Wasepi Series

The Wasepi series consists of nearly level to gently sloping soils that have a combined surface layer and subsoil less than 24 inches thick. These soils formerly in calcareous, sandy outwash. They are somewhat poorly drained.

In a typical profile the surface layer is neutral, very dark brown sandy loam about 7 inches thick. Below this is about 6 inches of slightly acid, pale-brown loamy sand that is mottled with strong brown.

The subsoil is about 11 inches thick. It is mildly alkaline, brown loam that is mottled with strong brown and gray to light gray.

The substratum is calcareous, light yellowish-brown to very pale brown sandy outwash mottled with strong brown and gray to light gray.

These soils can hold about 4 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderately rapid, internal drainage is slow, and natural fertility is low.

If these soils are adequately drained, they can be used for corn, small grains, legumes, and other cultivated crops commonly grown in the county. Most of the undrained areas are in pasture or trees.

Typical profile of Wasepi sandy loam, 1 to 3 percent slopes, in a cultivated field (SW¼SE¼ sec. 7, T. 11 N., R. 20 E.):

Ap—0 to 7 inches, very dark brown (10YR 2/2) sandy loam; weak, medium, granular structure; very friable; neutral; abrupt, smooth boundary.

A2—7 to 13 inches, pale-brown (10YR 6/3) loamy sand; few, fine, distinct mottles of strong brown (7.5YR 5/6); weak, medium, platy structure; very friable; slightly acid; clear, smooth boundary.

B2t—13 to 24 inches, brown (10YR 5/3) loam; common, medium, distinct mottles of strong brown (7.5YR 5/6) and gray to light gray (10YR 6/1); weak, medium, angular blocky structure; very friable; thin, patchy clay films on ped surfaces; mildly alkaline; clear, smooth boundary.

C1—24 to 28 inches, light yellowish-brown (10YR 6/4) sand; common, medium, distinct mottles of strong brown (7.5YR 5/6) and gray to light gray (10YR 6/1); single grain; loose; mildly alkaline; clear, smooth boundary.

C2—28 to 60 inches, very pale brown (10YR 7/4) sand; common, medium, distinct mottles of strong brown (7.5YR 5/6) and gray to light gray (10YR 6/1); single grain; loose; calcareous.

The Ap horizon generally is very dark brown (10YR 2/2), but it is very dark gray (10YR 3/1) in places. It ranges from 6 to 9 inches in thickness. In undisturbed areas the A1 horizon generally is black (10YR 2/1) and less than 4 inches thick. The substratum is fine or medium sand.

Wasepi soils have a coarser textured solum than the Fabius soils, which are underlain by gravelly materials.

Wasepi sandy loam, 1 to 3 percent slopes (WmA).—This soil has a seasonal high water table, but some areas are droughty in extended dry periods. Included with this soil in mapping are some areas that have slopes of more than 3 percent.

If adequately drained and properly managed, this soil is suited to some of the crops commonly grown in the county. Undrained areas have moderate limitations if used for cultivated crops. (Capability unit IVw–1; woodland group 7; recreation group 11; wildlife group 6)

Wet Alluvial Land

Wet alluvial land (Ww) consists of nearly level, poorly drained, loamy soils formed in alluvium. This land type forms an irregular pattern on stream flood plains in areas cut by flowing streams and older channels.

The texture of the surface layer and subsoil varies considerably in this land. The surface layer ranges from

sandy loam to silty clay loam. In many places the subsoil is stratified and has alternating sandy, loamy, and organic layers.

Because this land is subject to frequent flooding, it generally is not used for crops. It is suited to pasture, trees, or plants that provide food and cover for furbearing animals, migratory waterfowl, and other wildlife. (Capability unit VIIIw-1; woodland group 9; recreation group 3; wildlife group 7)

Yahara Series

The Yahara series consists of nearly level soils that formed from lake-laid silt and fine sand. These soils of the lowlands are somewhat poorly drained.

In a typical profile the surface layer is neutral, very dark brown coarse silt loam about 10 inches thick. Below this is about 3 inches of mildly alkaline, dark grayish-brown fine sandy loam.

The subsoil is about 17 inches thick. It is calcareous, light yellowish-brown fine sandy loam in the upper part. The lower part is weakly calcareous, light brownish-gray and light yellowish-brown fine sandy loam. The subsoil is mottled with yellowish brown, light brownish gray, and light gray.

The substratum is calcareous, light yellowish-brown, laminated silt and fine sand mottled with yellowish brown, light brownish gray, and light gray.

These soils can hold about 10 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, internal drainage is slow, and natural fertility is moderate.

Where these soils are adequately drained, they are used for corn, small grains, legumes, and other cultivated crops common in the county. Most undrained areas are in pasture or trees.

Typical profile of Yahara silt loam, 1 to 3 percent slopes, in a cultivated field (NE¼NE¼ sec. 1, T. 10 N., R. 19 E.):

Ap—0 to 10 inches, very dark brown (10YR 2/2) coarse silt loam; weak, fine, subangular blocky that breaks to moderate, medium, granular structure; friable; neutral; abrupt, smooth boundary.

A3—10 to 13 inches, dark grayish-brown (10YR 3/2) fine sandy loam; weak to moderate, fine, subangular blocky structure; friable; mildly alkaline; clear, wavy boundary.

B21—13 to 19 inches, light yellowish-brown (2.5Y 6/4 to 10YR 6/4) fine sandy loam; many, medium, distinct mottles of yellowish brown (10YR 5/6), light brownish gray (10YR 6/2) and light gray (10YR 7/1); weak, medium, subangular blocky structure; friable; calcareous; clear, wavy boundary.

B22—19 to 30 inches, light brownish-gray (10YR 6/2) and light yellowish-brown (10YR 6/4) fine sandy loam; many, medium, distinct mottles of yellowish brown (10YR 5/6), light brownish gray (10YR 6/2), and light gray (10YR 7/1); weak, medium, subangular blocky structure; friable; weakly calcareous; clear, smooth boundary.

C—30 to 60 inches +, light yellowish-brown (10YR 6/4) stratified silt and fine sand; many, medium, distinct mottles of yellowish brown (10YR 5/6), light brownish gray (10YR 6/2), and light gray (10YR 7/1); massive and single grain; friable; calcareous.

The A1 or Ap horizon generally is very dark brown (10YR 2/2), but in places it is very dark gray (10YR 3/1). Thickness ranges from 8 to 11 inches. The texture of most of the C horizon ranges from fine sand to fine sandy loam, but strata of silt are included.

Below the Ap horizon, Yahara soils are coarser textured than the Darroch soils. The Yahara soils are not so poorly drained as the poorly drained Granby soils, which formed in neutral to calcareous, loose sand instead of silt and fine sand.

Yahara silt loam, 1 to 3 percent slopes (YrA).—This soil has a seasonal high water table. Included with this soil in mapping are areas where the surface layer is loam or very fine sandy loam. Also included are small areas that have slopes of more than 3 percent and are slightly eroded.

If this soil is adequately drained and properly managed, it is well suited to the crops commonly grown in the county. In areas not drained, use for cultivated crops is moderately limited. (Capability unit IIw-3; woodland group 7; recreation group 4; wildlife group 6)

Zurich Series

The Zurich series consists of nearly level to very steep soils that formed in lake-laid silt and fine sand that has a silt mantle as much as 36 inches thick. These soils of the uplands are well drained.

In a typical profile the surface layer and subsoil are mildly alkaline. The surface layer is very dark grayish-brown silt loam about 5 inches thick. Below this is about 6 inches of dark grayish-brown silt loam.

The subsoil is about 14 inches thick. The upper part is brown silt loam, and the lower part is brown silty clay loam that has dark reddish-brown clay films on the soil aggregates, or peds.

The substratum is calcareous, very pale brown, laminated silt and very fine sand.

These soils can hold about 11 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, internal drainage is medium, and natural fertility is moderate.

These soils are used mostly for corn, small grains, legumes, and other cultivated crops commonly grown in the county. Most of the more sloping areas are in pasture or trees.

Typical profile of Zurich silt loam, 2 to 6 percent slopes, in an uncultivated area (SE¼NW¼ sec. 4, T. 11 N., R. 18 E.):

A1—0 to 5 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium, granular structure; very friable; mildly alkaline; abrupt, smooth boundary.

A2—5 to 11 inches, dark grayish-brown (10YR 4/2) silt loam; weak, thin, platy structure; very friable; mildly alkaline; clear, wavy boundary.

B1—11 to 18 inches, brown (7.5YR 4/4) silt loam; moderate, fine, subangular blocky structure; friable; mildly alkaline; clear, wavy boundary.

B2t—18 to 25 inches, brown (7.5YR 4/4) silty clay loam; moderate, fine, subangular blocky structure; friable; continuous, dark reddish-brown (5YR 3/4) clay films on ped faces; mildly alkaline; clear, wavy boundary.

C—25 to 60 inches +, very pale brown (10YR 7/4) laminated silt and very fine sand; massive; friable; calcareous.

The Ap horizon generally is dark grayish brown (10YR 4/2), but it is very dark grayish brown (10YR 3/2) in places. It ranges from 7 to 9 inches in thickness. In undisturbed areas the A1 horizon generally is very dark grayish brown (10YR 3/2) to very dark gray (10YR 3/1) and less than 6 inches thick. The solum ranges from 24 to 40 inches in thickness. The underlying material ranges from fine sand to silt.

Zurich soils are finer textured in their substratum than the Fox soils, which are underlain by stratified sand and gravel.

Zurich silt loam, 0 to 2 percent slopes (ZuA).—This soil has a profile similar to the one described as typical for the series, except that the thickness of the combined surface layer and subsoil is 30 inches instead of 25.

This soil of the uplands has few limitations if used for intensive cultivation. (Capability unit I–1; woodland group 1; recreation group 7; wildlife group 1)

Zurich silt loam, 2 to 6 percent slopes (ZuB).—This soil has the profile described as typical for the series (fig. 22). Underlying silt and sand is at a depth of about 28 inches.

This soil is susceptible to erosion, but crops common in the county grow well in areas that are properly managed. (Capability unit IIe–1; woodland group 1; recreation group 7; wildlife group 1)

Zurich silt loam, 2 to 6 percent slopes, eroded (ZuB2).—This soil has a thinner surface layer than the profile described as typical for the series. It generally is eroded in cultivated areas and has a lighter colored plow layer than the surface layer in uncultivated areas.

This soil of the uplands is susceptible to further erosion and has moderate limitations if used for intensive cultivation. If this soil is left unprotected, erosion thins the surface layer and lowers fertility. Where management is good, crops grow well. (Capability unit IIe–1; woodland group 1; recreation group 7; wildlife group 1)

Zurich silt loam, 6 to 12 percent slopes, eroded (ZuC2).—This soil of the uplands has a lighter colored surface layer than that in the profile described as typical for the series, and the thickness of the combined surface layer and subsoil is about 24 inches, or about an inch thinner than typical. Included in mapping are pastured or wooded areas that are only slightly eroded.

This soil is susceptible to further erosion, and it has moderately severe limitations if used for intensive cultivation. If this soil is left unprotected, erosion thins the surface layer and reduces fertility.

Careful management is needed to control erosion. (Capability unit IIIe–1; woodland group 1; recreation group 7; wildlife group 1)

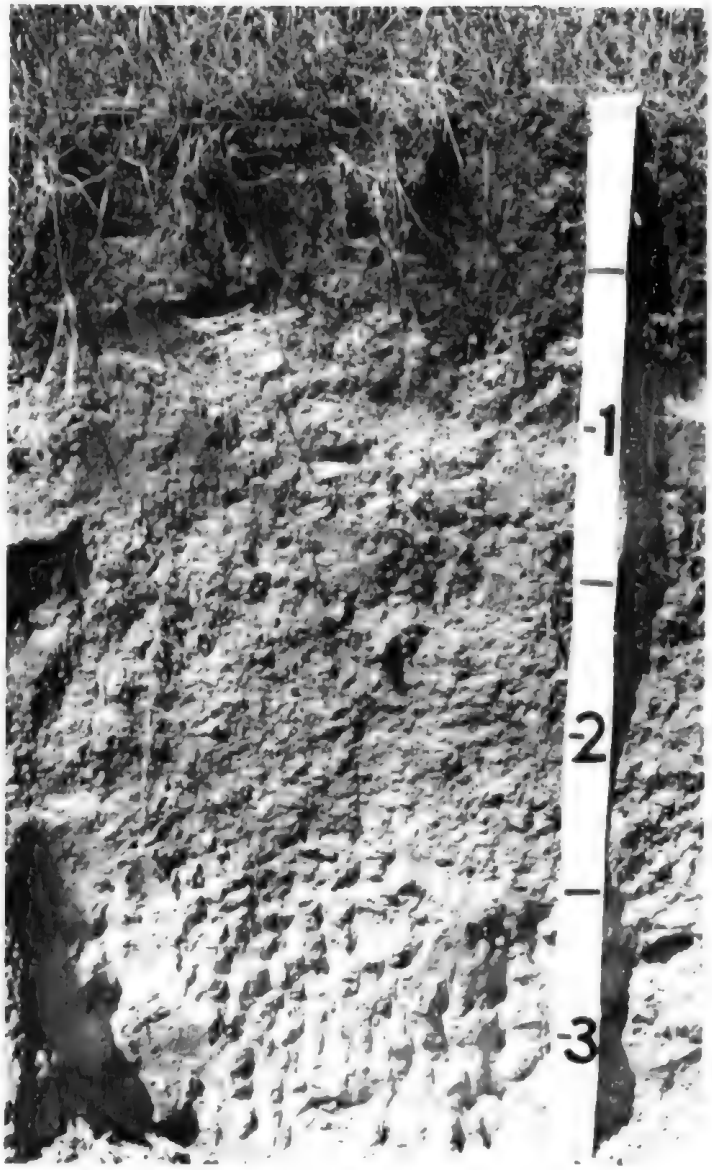

Figure 22.—**Typical profile of Zurich silt loam, 2 to 6 percent slopes, in an uncultivated area.**

Formation, Morphology, and Classification of Soils

The first part of this section discusses the factors of soil formation as they relate to the formation of soils in Washington County. Then important processes that affect the development of soil horizons are explained. The third part describes the system of soil classification currently used and places the soil series of the county in some of the categories of that system. Each soil series, including a profile typical for the series, is described in the section "Descriptions of the Soils."

Formation of Soils

Soil is produced by the action of soil-forming processes on material deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent materials; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time the processes of soil development have acted on the soil material.

Climate and plant and animal life, particularly vegetation, are active forces in soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body, or soil, having genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed for the changing of the parent material into a soil profile. Usually a long time is needed for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one unless conditions are specified for the other four. Many of the processes of soil development are unknown.

Parent material.—The parent material in Washington County consists of glacial till and outwash, wind-laid silty material, water-deposited material, and organic residue.

The till is a mixture of ground rock that is a result of glacier action. It contains varying amounts of dolomitic stones, gravel, quartz, sand, and silt. Large stones are common on the surface. Soils of the Hochheim series are examples of soils that formed from calcareous loamy till.

The outwash in the county consists of loose sand and gravel that have been transported by rapidly moving water from the melting ice of the glaciers. The finer rock particles have been washed away. Most of the stones in the outwash have been rounded and smoothed by the rapidly moving water. Examples of soils formed from outwash are those of the Casco and Fox series.

Many areas in the county have a layer of wind-laid silty soil on them. In such areas the surface layer is silt loam. Soils of the Theresa series are examples of soils that have formed partly from wind-laid silty material.

In some areas, stratified silt, clay, and fine sand were deposited in slowly moving or stagnant water of temporary lakes. Some of the lakes were formed by ice barriers and others by the digging action of glaciers. The Saylesville and Zurich soils are examples of soils formed in the old lakebeds.

Deposits of organic residue occur throughout the county. These deposits consist of partly decomposed reeds, sedges, trees, and other plants. Many of the deposits are deep. Soils of the Adrian and Houghton series are examples of soils that formed in deep deposits of organic residue.

Climate.—In general, climate affects the environment through the moisture and heat that it contributes. For example, as precipitation increases and the temperature rises, the content of clay in soils tends to increase. In this county the temperature and precipitation are favorable for growth of trees and for development of soils that have a surface layer that is thin or light colored and a subsoil in which clay has accumulated.

Plants and animals.—Plants have been the principal biological factor in the formation of soils in this county, but bacteria, fungi, earthworms, insects, and rodents also have been important. Two of the chief functions of plant and animal life are to furnish organic matter and to bring plant nutrients from the lower to the upper horizons. Among the changes caused in soils by plants and animals are differences in the amount of organic matter, nitrogen, and plant nutrients in the soils and differences in soil structure and porosity.

The most pronounced differences among the soils in the county are caused by vegetation. An example of the influence of vegetation on the characteristics of the soils is the contrast between the dark-colored Mundelein soils that formed under grass and the lighter colored Kendall soils that formed under trees.

Relief.—In Washington County the elevation ranges from about 850 feet in basins where organic soils have formed to about 1,100 to 1,200 feet in areas characterized by the Theresa and Hochheim soils. The Kettle Moraine extends from the north-central part of the county to the southwestern part. The moraine is characterized by sharp relief that includes many small closed basins (kettles) and steep hills. The soils at the higher elevations are mainly of the Hochheim series, and they formed in calcareous till. At lower elevations, there are large areas of sand and gravel outwash where Fox, Casco, and Rodman soils formed. The relief in some of these areas, especially where Casco and Rodman soils formed, is relatively sharp. On either side of the Kettle Moraine are areas of low relief where St. Charles soils formed or where gently sloping Fox soils are underlain by sand and gravel outwash.

The Pella, Palms, Houghton, and similar soils formed in areas of low elevation.

Time.—Time is required for active agents of soil development to form soils from parent material. Some soils form rapidly, and others form slowly. The length of time required for a particular kind of soil to form depends on the other factors involved.

Most of the soils of Washington County began forming during or shortly after the Wisconsin glaciation. The last of these glaciers moved into the county about 11,000 years ago.

As soils began to form, they have characteristics almost identical to those of the parent material and are said to be immature. Among such immature soils are those of the Sebewa series. The material of these soils was deposited recently compared to that of the most other soils in the county. In these immature soils little horizon development has taken place, though there may be some layering. Through a long period of time, soils may go through successive stages of immaturity, maturity, and old age.

A soil is said to be mature when it has well-developed horizons and is nearly in equilibrium with its present environment. At that time, the soil-forming factors effect few changes in the soil material. Not all soil components, however, mature at the same rate, nor is there a reliable method of determining accurately when a soil is in equilibrium with its environment. Theresa soils are examples of soils in this county that have a well-developed profile. These soils are acid in reaction. Clay from the upper part of the profile has accumulated in the subsoil, and the underlying layer contains carbonates leached from the profile.

Morphology of Soils

Soil morphology in Washington County generally is expressed by horizons in the soil profile, or the succession of horizons from the surface down to the unaltered material. The horizons may vary in thickness from place to place, and they may differ in one or more properties, such as color, texture, structure, consistence, porosity, and reaction.

Most soil profiles contain three major horizons, the A, B, and C, though a B horizon has not developed in some young or immature soils.

If the A horizon, or surface layer is the horizon having maximum content of organic matter it is called the A1

horizon. If the A horizon contains a horizon in which leaching of dissolved or suspended materials is maximum, it is called the A2 horizon.

The B horizon, which lies just beneath the A horizon, is called the subsoil. This is the horizon in which there is maximum accumulation of iron, clay, or other dissolved or suspended materials. The B horizon generally is firmer than adjacent horizons above and below it and in many places it has blocky structure.

The C horizon is just beneath the B horizon. This layer, called the substratum or underlying material, is relatively little affected by soil formation, but it generally is modified by weathering.

Important processes in the formation and differentiation of soil horizons in the soils of the county are (1) accumulation of organic matter, (2) leaching of calcium carbonate and bases, (3) reduction and transfer of iron, and (4) accumulation of silicate clay minerals. In most soils more than one of these processes affected the development of the horizons.

Accumulation of organic matter in the A1 horizon has been important in Washington County. The soils in this county range from high to low in content of organic matter.

Leaching of carbonates and bases has occurred in nearly all of the soils of the uplands. Soil scientists generally agree that the leaching normally precedes translocation of silicate clay minerals. In this county most of the soils of the uplands are moderately to strongly leached. Soils of the lowlands normally are high in carbonates because the soils have been recharged by ground water that is high in carbonates.

The reduction and transfer of iron, a process called gleying, has occurred in the poorly drained and very poorly drained soils of the county. The gray colors in the deeper horizons indicate the reduction and loss of iron. Some horizons contain reddish-brown mottles which indicate segregation of iron.

The translocation of silicate clay minerals in some of the soils of Washington County has contributed to the development of horizons. The eluviated A2 horizon generally has a platy structure and is lower in content of clay than the B horizon and generally lighter in color. The B horizon of these soils generally has clay films in the pores and on the ped surfaces. These soils probably were considerably leached of carbonates and soluble salts before the translocation of silicate clays. The Theresa is an example of a soil that has translocated silicate clays, which accumulated in the B horizon in the form of clay films.

Classification of Soils

Soils are classified so that we may more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationships to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

Thus in classification, soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils can be organized and used in managing farms, fields, and woodland; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

The current system of classifying soils was adopted for general use by the National Cooperative Soil Survey in 1965. This system is under continuous study. Readers interested in developments of this system should search the latest literature available (*2*, *6*).

Under the current system of classifying soils (*6*), all soils are placed in six categories. Beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. The criteria used as a basis for classification in this system are observable or measurable properties. The properties are so chosen that soils of similar mode of origin are grouped together.

In table 8 the soil series of Washington County are placed in some of the classes of the current system. The classes of the current system are briefly defined in the following paragraphs.

ORDERS. Ten soil orders are recognized in the current system. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. Two exceptions, the Entisols and Histosols, occur in many different kinds of climate. Each order is named with a word of three or four syllables ending in *sol* (Ent-i-*sol*).

Table 8 shows that the five soil orders recognized in Washington County are Alfisols, Entisols, Inceptisols, Mollisols, and Histosols.

Alfisols are soils that have clay-enriched B horizons that are high in base saturation. In Washington County, most of the soils that have been called Gray-Brown Podzolic soils are Alfisols.

Entisols are recent soils that do not have genetic horizons or have only beginnings of such horizons. In Washington County this order includes many, but not all, of the soils previously classified as Alluvial soils and Regosols.

Inceptisols are mineral soils in which genetic horizons have started to develop. Their name is derived from the Latin *inceptum*, which means beginning. In Washington County this order includes some soils that formerly were called Alluvial soils, Regosols, and Low-Humic Gley soils.

Mollisols are soils that have a friable, thick, dark-colored surface layer. Base saturation is more than 50 percent. In Washington County the Mollisols developed under grass. They were called Brunizems and Humic Gley soils.

Histosols are soils developed in organic material. They formerly were called mucks and peats.

SUBORDERS. Each order is subdivided into suborders, primarily on the basis of those soil characteristics that seem to produce classes having the greatest genetic similarity. The suborders narrow the broad climatic range

TABLE 8.—*Soil series classified according to the current system of classification*[1]

Series	Family	Subgroup	Order
Adrian	Sandy or sandy-skeletal, euic, mesic	Terric Medisoprists	Histosols.
Ashkum	Fine, mixed, noncalcareous, mesic	Typic Haplaquolls	Mollisols.
Aztalan	Fine-loamy, mixed, mesic	Aquic Argiudolls	Mollisols.
Boyer	Coarse-loamy, siliceous, mesic	Typic Hapludalfs	Alfisols.
Brookston	Fine-loamy, mixed, noncalcareous, mesic	Typic Argiaquolls	Mollisols.
Casco	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Typic Hapludalfs	Alfisols.
Colwood	Fine-loamy, mixed, noncalcareous, mesic	Typic Haplaquolls	Mollisols.
Darroch, neutral variant	Fine-loamy, mixed, mesic	Aquic Argiudolls	Mollisols.
Dodge	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Dresden	Fine-loamy or sandy over sandy-skeletal, mixed, mesic.	Mollic Hapludalfs	Alfisols.
Drummer	Fine-silty, mixed, noncalcareous, mesic	Typic Haplaquolls	Mollisols.
Fabius	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Aquic Argiudolls	Mollisols.
Fox	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Typic Hapludalfs	Alfisols.
Granby	Sandy, mixed, noncalcareous, mesic	Typic Haplaquolls	Mollisols.
Grays	Fine-silty, mixed, mesic	Mollic Hapludalfs	Alfisols.
Hebron	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Hennepin	Fine-loamy, mixed, mesic	Typic Eutrochrepts	Inceptisols.
Hochheim	Fine-loamy, mixed, mesic	Typic Argiudolls	Mollisols.
Houghton	Euic, mesic	Typic Medaprists	Histosols.
Houghton, acid variant	Dysic, mesic	Typic Medaprists	Histosols.
Juneau	Coarse-silty, mixed, nonacid, mesic	Typic Udifluvents	Entisols.
Kendall	Fine-silty, mixed, mesic	Aquic Ochraqualfs	Alfisols.
Keowns	Coarse-loamy, mixed, calcareous, mesic	Mollic Haplaquepts	Inceptisols.
Knowles	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Lamartine	Fine-silty, mixed, mesic	Aquollic Hapludalfs	Alfisols.
Martinton	Fine, illitic, mesic	Aquic Argiudolls	Mollisols.
Matherton	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Udollic Ochraqualfs	Alfisols.
Mayville	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Mequon	Fine, mixed, mesic	Udollic Ochraqualfs	Alfisols.
Montgomery	Fine, mixed, noncalcareous, mesic	Typic Haplaquolls	Mollisols.
Mundelein	Fine-silty, mixed, mesic	Aquic Argiudolls	Mollisols.
Mussey	Fine-loamy over sandy or sandy-skeletal, mixed, noncalcareous, mesic.	Typic Argiaquolls	Mollisols.
Nenno	Fine-loamy, mixed, mesic	Aquic Argiudolls	Mollisols.
Otter	Fine-silty, mixed, noncalcareous, mesic	Cumulic Haplaquolls	Mollisols.
Ozaukee	Fine, mixed, mesic	Typic Hapludalfs	Alfisols.
Palms	Loamy, euic, mesic	Terric Medisaprists	Histosols.
Pella	Fine-silty, mixed, noncalcareous, mesic	Typic Haplaquolls	Mollisols.
Radford	Fine-silty, mixed, mesic	Aquic Fluventic Hapludolls	Mollisols.
Ritchey	Loamy, mixed, mesic	Lithic Hapludalfs	Alfisols.
Rodman	Sandy-skeletal, mixed, mesic	Typic Hapludolls	Mollisols.
St. Charles	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Saylesville	Fine, illitic, mesic	Typic Hapludalfs	Alfisols.
Sebewa	Fine-loamy over sandy or sandy-skeletal, mixed, noncalcareous, mesic.	Typic Argiaquolls	Mollisols.
Sisson	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Theresa	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Virgil	Fine-silty, mixed, mesic	Udollic Othraqualfs	Alfisols.
Wallkill	Fine-loamy, mixed, nonacid, mesic	Thapto Histic Haplaquepts	Inceptisols.
Wasepi	Coarse-loamy, mixed, mesic	Aquollic Hapludalfs	Alfisols.
Yahara	Coarse-loamy, mixed, mesic	Aquic Hapludolls	Mollisols.
Zurich	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.

[1] Placement of some soil series in the current system of classification, particularly in families, may change as more information becomes available.

permitted in the order. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging or that reflect soil differences resulting from the climate or vegetation. The names of suborders have two syllables. The last syllable indicates the order. An example is Psamments (Psamm, meaning sandy, and ent, from Entisol). Suborders are not given in table 8, because the last two syllables of the subgroup name the suborder.

GREAT GROUPS. Soil suborders are separated into great groups according to the presence and absence of genetic horizons and the arrangement of these horizons. The horizons used to make separations are those in which clay, iron, or humus has accumulated or those that have pans that interfere with the growth of roots or the movement of water. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, mag-

nesium, sodium, and potassium), and the like. The names of great groups have three or four syllables. They are made by adding a prefix to the name of the suborder. An example, is Argiaquoll (argi, meaning clay; aqu, for water; and oll, from Mollisol). The great group is not shown separately in table 8, because it is the last word in the name of the subgroup.

SUBGROUPS. Great groups are subdivided into subgroups, one representing the central (typic) segment of the group and others, called intergrades, that have properties of the group and also one or more properties of another great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Typic Argiaquoll (a typical Argiaquoll).

FAMILIES. Families are separated within a subgroup, primarily on the basis of properties that are important to the growth of plants or the behavior of soils used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives that precede the name of a subgroup. The adjectives used are the class names for texture, mineralogy, and so on that are used to designate family. An example is the fine-loamy, mixed, noncalcareous, mesic family of Typic Argiaquolls.

General Nature of the County

This section provides general information about Washington County. First discussed is the climate of the county. Then described are the outstanding features of agriculture, including information of the types and sizes of farms, the crops grown, permanent pasture, livestock and livestock products, and farm income and expenditures. Finally, the settlement and development of the county are discussed.

Climate [2]

Washington County has a dominantly continental climate that is modified by Lake Michigan (*4*). The effects of the lake are most pronounced in spring and early in summer, when the prevailing wind is off the lake, and are least in winter, when the prevailing wind is westerly. The modifications of the weather by Lake Michigan are greatest in the eastern half of the county, and they diminish rapidly in the western part. Also influencing the weather are the high and low pressure systems that move eastward across the continent and low pressure systems that move northeastward from the southwest.

The length of daylight varies from 15 hours and 24 minutes late in June to 8 hours and 59 minutes late in December. Because each season is distinctive, the weather varies widely throughout the year.

Winters are relatively cloudy, cold, and snowy. The coldest air in winter comes down from the vast, snow-covered plains of Canada. Streams and small lakes in the county generally are frozen from late in November to early in April. Changes in weather can be expected every 2 or 3 days from late in fall through the middle of spring.

Warm weather in spring is slow in coming, and the first part of spring is marked by alternate warm and cold periods. Early in spring, low temperatures are moderated but high temperatures are not frequent. Snowfall decreases and by the end of March, most precipitation falls as rain. As spring becomes warmer, precipitation lessens in frequency, but increases in intensity. Warmer weather, however, is delayed by the relatively cool winds blowing off Lake Michigan from the northeast.

Summers are warm but normally have several hot and humid periods. The highest temperatures occur when warm moist air comes to the area from the Gulf of Mexico or the Caribbean Sea. Cool periods may occur during any summer month. Dew forms on most summer mornings, and it often is heavy.

Cool weather in fall arrives suddenly in mid-September and usually continues into November. During fall relatively warm winds off Lake Michigan tend to prevent temperatures at night from being as low in the eastern part of the county as they are farther inland. Nearly every fall has one or more periods of Indian summer, when the days are abnormally warm, skies are generally cloudless but hazy, and the nights are cool. The change from fall to winter often is abrupt.

Table 9 gives climatic data of Washington County. The data was compiled from records of the U. S. Weather Bureau Station at West Bend, where elevation is 940 feet. Among the data given in table 9 are average degree days for each month (*3*). The number of degree days in a given day is the difference between the average temperature that day and the 65° F. For example, on a day having an average temperature of 50°, 15 degree days would be counted. The degree days listed in table 9 is the monthly average for the 30-year period of record. A knowledge of accumulated degree days for a stated time is helpful in calculating the amount of fuel needed for heating buildings and for determining the rate of growth and the maturity date of crops.

Temperature

The temperature in the county varies greatly from season to season, and commonly from day to day and from year to year. July is the warmest month and January the coldest. During spring and early in summer, the wind shifts from a west to an easterly direction from Lake Michigan. This shift frequently results in a 5° to 10° drop in daytime temperatures. In winter the influence of the lake on cold waves is negligible because the cold air sweeps across the State from the Northwest before it comes in contact with the lake. On an average of 13 days in a year, temperatures are 90° or higher, but the range is none to more than 30 days. The average number of days in a year when the temperature is 0° or lower is 15, but the number ranges from more than 40 to less than 5. In 1 year out of 10, the temperature is 100° or higher on 1 or more days, and in 1 year out of 5, it is 20° below zero or lower on 1 or more days.

Table 10 shows the probability of freezing temperatures on or after given dates in spring and on or before given dates in fall. The average growing season, or the number of days between the last 32° freeze in spring and

[2] By HANS E. ROSENDAL, State climatologist, Weather Bureau, Environmental Science Services Administration, U.S. Department of Commerce.

TABLE 9.—*Temperature and precipitation at West Bend, Wis.*

[Period 1930–59]

Month	Temperature		Average degree days	Precipitation	
	Average daily maximum	Average daily minimum		Average total	Average snowfall and sleet
	°F.	°F.	Number	Inches	Inches
January	28.6	11.7	1,390	1.68	12.3
February	31.0	13.5	1,200	1.36	8.1
March	39.9	23.0	1,040	2.01	10.5
April	54.9	34.6	610	2.54	1.2
May	67.5	45.4	300	2.98	.4
June	77.4	55.8	80	3.96	0
July	82.9	60.7	20	3.34	0
August	80.8	59.5	30	2.89	0
September	72.4	51.3	150	3.16	(1)
October	60.8	41.1	430	2.21	.1
November	44.1	27.8	870	2.13	2.9
December	32.0	16.7	1,260	1.50	7.8
Year	56.0	36.8	7,380	29.76	43.3

[1] Trace.

TABLE 10.—*Probabilities of last freezing temperatures in spring and first in fall*

Probability	Dates for given probability and temperature				
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring:					
2 years in 10 later than	April 3	April 12	April 21	May 4	May 20
4 years in 10 later than	March 26	April 4	April 14	April 27	May 13
6 years in 10 later than	March 20	March 28	April 7	April 20	May 7
8 years in 10 later than	March 13	March 20	March 31	April 13	April 30
Fall:					
2 years in 10 earlier than	November 9	October 31	October 20	October 9	September 28
4 years in 10 earlier than	November 17	November 8	October 28	October 17	October 4
6 years in 10 earlier than	November 24	November 14	November 4	October 23	October 11
8 years in 10 earlier than	December 1	November 22	November 11	October 31	October 18

the first in fall, is 130 days in the western part of the county and about 160 days in the eastern part.

Table 11 gives the average number of growing-degree-days above three base temperatures for the months of April through October. Growing-degree-days are based on the concept that plant growth and insect development begin at the time certain critical temperatures are reached and that the amount of plant growth or insect development is roughly proportional to the number of accumulated degree days. The number of growing-degree-days is computed by subtracting the daily average temperature from a chosen base. For example, an average temperature of 60° would have 20 growing degrees above a base of 40°, 15° above a base of 45°, and 10° above a base of 50°. On days when the average temperature is the same or lower than the base temperature, the number of growing-degree-days is zero.

Freezing of the ground usually begins late in November or early in December and lasts until early in April. The depth that frost penetrates varies considerably. If snow is 10 inches deep or more before the ground has frozen deeply, and if such cover remains all winter, frost penetrates to a depth of only a few inches, regardless of how low the temperature drops. Soils, however, are likely to freeze to a depth of 36 inches or more in years when the ground freezes before the snow comes, and when temperatures are low and the snow cover is light and does not remain on the ground.

Precipitation

Annual precipitation normally is adequate for the crops grown. Although the supply of moisture is low in July and August, a severe drought that damages all crops is rare. About 55 percent of the annual rainfall

TABLE 11.—*Growing-degree-days for specific months*

Month	Base 40° F.	Base 45° F.	Base 50° F.
April	200	110	50
May	500	370	250
June	800	650	500
July	990	830	680
August	940	780	630
September	660	510	360
October	350	230	120
Total	4440	3480	2590
Total for growing season	3900	3130	2400

comes in the months of May through September. Summer precipitation falls mainly in local showers. Total precipitation is important, but distribution during the growing season also influences plant growth.

About 1 inch of rain is needed each week in summer for good growth of crops, but there is little probability of receiving this amount of rain during a 7-day period of the growing season. Early in June and early in August, a weekly rainfall of 1 inch or more can be expected 4 years in 10. During the last half of July and late in August the probability of receiving this amount is only 2 years in 10. The probability of receiving a week of no rainfall or just a trace is greatest late in August. This occurs in 2 years out of 10. The number of days in a year when 0.01 inch or more of precipitation falls averages 118, but it ranges from 108 to 128 days in 2 years out of 3.

The occurrence of dry days, or days having less than 0.10 inch of rain, is important. For example, in making field-cured hay of top quality, 3 or more consecutive dry days are needed. The probability of having 3 such days in a row is about 50 percent in June and is 55 percent in July and August.

A knowledge of annual precipitation and daily amounts of 0.5 inch or more is useful in estimating the hazard of erosion. Rainfall less intensive than 0.5 inch a day is not likely to cause gullying. Table 12 gives a summary of the amount of precipitation, lasting for a specified length of time from 30 minutes to 10 days, that can be expected in the return periods indicated. The data are for a 24-hour observation period and not for 24 consecutive hours. The amounts, therefore, are a little low. No distinction is made between rainfall and snowfall. In Washington County, the average number of days that have 0.5 inch or more of precipitation is 20. About 60 percent of the annual precipitation falls on days that receive 0.5 inch or more.

The average annual fall of snow and sleet is about 43.3 inches, though the amount ranges from 22 to 82 inches. The average date of the first snowfall of 1 inch or more is November 29. The chance that 1 inch or more of snow will fall by November 5 is 1 year in 10, and the chance that this amount will fall by December 24 is 9 years in 10. The probability of snow on the ground increases until the middle of February and then decreases rapidly.

Thunderstorms, hail, and winds

Thunderstorms occur on an average of 38 days a year. In some years they have occurred as few as 25 days, and in other years as many as 55 days. Thunderstorms occur on an average of 7 days in June and July, 6 days in August, 5 days in May, 4 days in September and in April, 2 days in October and in March, 1 day in November, and rarely in December, January, and February. Thunderstorms occur most frequently between noon and 6:00 p.m. They are the least frequent between 6 a.m. and noon. Severe storms are most frequent in July, between 2 and 7 p.m.

Hail falls on an average of 2 days a year. It is most frequent late in afternoon in midspring. Damaging hailstorms occur most often late in the afternoon in mid-July, but they have occurred at other times. Hailstorms are rare from mid-September to mid-March and between the sunset and sunrise. Most hailstorms are local and last only for a few minutes.

Prevailing winds are from the northwest from November through March, from the northeast from April through June, and from the southwest from July through October. The strongest winds blow in March, April, and November, and in these months the average speed of the wind is 14 miles per hour. Least windy are June and July, when the windspeed averages only 10 miles per

TABLE 12.—*Amount of precipitation of stated duration to be expected once in the specified number of years*

Duration	Return period of—						
	1 year	2 years	5 years	10 years	25 years	50 years	100 years
30 minutes	0.9	1.1	1.3	1.5	1.7	1.9	2.2
1 hour	1.2	1.4	1.7	1.9	2.2	2.4	2.7
2 hours	1.4	1.6	2.0	2.3	2.6	2.8	3.2
3 hours	1.5	1.7	2.2	2.4	2.8	3.1	3.5
6 hours	1.8	2.0	2.5	2.9	3.4	3.8	4.0
12 hours	2.0	2.4	3.0	3.4	3.9	4.3	4.9
24 hours	2.3	2.6	3.3	3.9	4.5	5.0	5.5
2 days		3.0	4.0	4.5	5.2	6.0	6.4
4 days		3.6	4.7	5.2	6.3	6.9	7.8
7 days		4.0	5.2	6.0	7.0	7.9	8.8
10 days		4.5	5.9	6.7	8.0	9.0	9.8

hour. At some time in about half of the years, wind, other than gusts, can be expected to blow as much as 55 miles per hour at about 30 feet above the ground and as much as 45 miles per hour at about 10 feet. About once in 50 years, windspeeds can be expected to reach 100 miles per hour at about 30 feet above the ground and 85 miles per hour at about 10 feet. Because of the surface friction, windspeed at plant height is considerably less than that at either 30 or 10 feet.

Sunshine, relative humidity, and evaporation

Washington County receives, on the average, about 55 percent of the possible sunshine during the year. About 40 percent of the possible sunshine is received from November through February, between 50 and 60 percent, from March through September. Only in July is the average more than 70 percent.

Relative humidity normally varies from hour to hour, day to day, and season to season. Generally, it is highest near daybreak and lowest early in the afternoon. Shown in table 13 are the percentages of time during the four midseasonal months that relative humidity is within six specified ranges of percentage between 0 and 100. For example, relative humidity ranges from 30 to 49 percent for 3 percent of January, 17 percent of April, 11 percent of July, and 12 percent of October. The data in table 13 were taken from records in Milwaukee.

Annual evaporation from lakes is nearly 29 inches of this amount; about 80 percent evaporates from May through October.

TABLE 13.—*Range in relative humidity in January, April, July, and October*

Relative humidity	Percentage of time in —			
	January	April	July	October
Percent				
0–29	(1)	4	(1)	2
30–49	3	17	11	12
50–69	29	30	29	29
70–79	29	17	20	19
80–89	25	15	22	20
90–100	14	17	18	18

[1] Less than 1 percent.

Farming

Farming, mainly dairying, is a major enterprise in Washington County. The sale of milk and milk products accounts for most of the farm cash income. Livestock and related products account for the major part of farm income, but the sale of crops, mainly sweet corn, peas, and beets, also is important.

In 1964, according to the U.S. Census of Agriculture, the total land in farms was 211,556 acres or 77.2 percent of the total acreage of the county. Of this, 130,008 acres was in harvested cropland, and about 26,945 acres was wooded. Only 11,091 acres was used solely for pasture, but 12,171 acres of woodland was grazed, and 13,513 acres of cropland was being used as pasture. Thus the total area pastured amounted to 36,775 acres.

The number of farms in the county in 1964 was 1,715, and the average size of the farms was 123.4 acres. Of these farms, 1,025 were operated by owners, 511 by part owners, 177 by tenants, and 2 by managers. Cash tenants are the most common tenants in the county and are increasing. About 42 percent of the farm operators in the county worked off the farm in addition to their farming activity.

Dairy cattle are the chief livestock in the county. The principal breed of dairy cattle is Holstein, but other breeds such as Guernsey and Brown Swiss are also raised. Herefords and Aberdeen Angus are the most common breeds of beef cattle. The total number of cattle in the county has increased from 51,411 in 1959 to 53,977 in 1964.

The number of hogs and pigs has decreased in Washington County in recent years. In 1959, 21,700 hogs and pigs were in the county, but in 1964, only 16,180 hogs and pigs were reported.

The number of sheep and lambs in Washington County has decreased steadily in recent years. In 1959, 1,488 sheep and lambs were reported in the county, but in 1964, only 852 were counted.

Total egg production has remained fairly stable in recent years. The number of chickens 4 months old and older, however, has decreased from 154,661 in 1959 to 151,128 in 1964. Better management has increased the production of eggs per fowl. Turkeys and turkey fryers raised in the county have remained stable in recent years. In 1964, 3,007 turkeys and turkey fryers were raised.

Corn has a larger acreage than any other crop grown in Washington County. In 1964, 33,221 acres were in corn. Oats and hay crops rank second and third, respectively, in the total acreage grown in the county.

Corn is grown on all soils suited to row crops in the county. About 1¼ million bushels of corn were harvested for grain in 1964. Harvesting usually is in October or November, depending on the weather. Corn cut for silage generally is harvested when the grain begins to dent. If an early frost occurs, the crop is harvested as soon as possible after the first frost.

Oats grown for grain occupy about 30,856 acres in the county. Most oats are grown as a nurse crop for hay. Fields used for oats are plowed either in fall or in spring. If the soil is plowed and disked, oats can be seeded in April. A grain drill is usually used for seeding, but oats can be broadcast and covered by harrowing.

Hay crops are grown extensively in the county. In some areas where the soils are too steep for cultivation of row crops, hay is primarily used. Alfalfa, the most common hay crop, generally gives higher yields of good quality forage than other kinds of hay. Alfalfa needs a good, well-drained, fertile soil for good growth. It is generally seeded in April with small grains that serve as a nurse crop. Three cuttings generally are made. Some alfalfa is used for pasture.

The production of red beets in the county is the highest in the State. The red beets are grown for canning, as are sweet corn, peas, cabbage, and carrots. Grass sod is grown for landscaping uses.

Approximately 15 percent of the acreage of the farmland in the county is in permanent pasture, consisting mostly of native grasses. Pastured woodland is not well

suited to trees and does not give good yields of forage. Many areas of soils that are too steep or too stony cannot be renovated. These areas can be fenced to keep cattle out and then can be used for trees and as habitat for wildlife. If feasible, wooded areas that are needed for pasture should be cleared. In many areas permanent pastures provide little forage, but they can be improved by renovation.

Settlement and Development

Washington County was a part of Ozaukee County, but on December 7, 1836, the present boundaries were established by territorial legislation. The new county was named for George Washington.

The first white men in the area were Father Jacques Marquette and Louis Joliet. These explorers visited the region in 1673, when they skirted the Wisconsin shore of Lake Michigan after exploring the Mississippi River. It is not known, however, whether any explorers actually set foot inside what is today Washington County.

By the last half of the 1830's, frontier settlers were approaching Washington County. They located first in the southeastern corner of the county and then spread north and west. Early settlers of German and Irish descent purchased most of the land and farmed it according to their experience in their homeland.

Most of the area was densely forested at the time of settlement, and clearing was a slow process. The size of the average farm was about 80 acres. The abundant available water supply and other resources made the area desirable for those having little capital to invest. By 1850 all desirable land had been purchased.

Sawmills, flour mills, and breweries made use of the excellent water supply and ample supply of grains and trees. In the early 1860's three railroads were constructed in the county, and the area was made into a greater marketing region. Lumber became a major marketing product because wood was needed as a source of fuel.

Wheat and rye were the first major cash crops in the county. After 1889, however, wheat production declined sharply and a diversified type of farming became popular. This diversification led to the present enterprise of dairying.

In Washington County industrial and agricultural production are about equal. The industrial economy is made up largely of agricultural machinery, cookware, and leather products. Many vegetables that are prepared commercially in the county provide part-time employment for residents. Much of the population is involved in trade and clerical work.

Recreational facilities are provided in the county by the numerous lakes and streams. Summer and winter outdoor sports are popular. In the Kettle Moraine region of the county are facilities for camping, hiking, hunting, and other outdoor sports. Fishing, hunting, and camping areas are numerous throughout the county. Living accommodations and churches are readily available.

The population of Washington County has steadily increased since the time of the early settlers. In 1960 the population was 46,119.

Literature Cited

(1) American Association of State Highway Officials.
1961. standard specifications for highway materials and sampling and testing. Ed. 8, 2 v., Washington, D.C.

(2) Simonson, Roy W.
1962. soil classification in the united states. Sci. 137: 1027–1034.

(3) Thom, H. C. S.
1954. the rational relationship between heating degree days and temperature. Monthly Weather Rev. 82: 1–6, illus.

(4) United States Department of Agriculture.
1941. climate and man. U.S. Dept. of Agr. Yearbook 1941, 1248 pp., illus.

(5) _____
1951. soil survey manual. Agr. Handbook No. 18, 503 pp., illus.

(6) _____
1960. soil classification, a comprehensive system, 7th approximation. 265 pp., illus. [Supplement issued in March 1967]

(7) Waterways Experiment Station, U.S. Corps of Engineers.
1953. the unified soil classification system. Tech. Memo. 3–357, 2 v., and appendix.

Glossary

Acidity. See Reaction, soil.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water (or water holding) capacity. The capacity of a soil to hold water *in* a form available to plants. Amount of moisture held in soil between field capacity, or about one-third atmosphere of tension, and the wilting coefficient, or about 15 atmospheres of tension.

Blinding. The practice of placing permeable material, such as sawdust, woodchips, or coarse aggregate, around newly installed drainage tile to filter out sand, silt, and clay but allow water to enter the tile freely.

Bottom land. Nearly level land on the bottom of a valley that has a stream flowing through it. Subject to flooding and often referred to as a flood plain.

Calcareous. A soil that contains enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour or that are parallel to terraces or diversions; strips of grass or close-growing crops are alternated with strips of clean tilled crops or summer fallow.

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Dolomite. A calcium-magnesium carbonate mineral. Limestone that contains magnesium carbonate is commonly called dolomitic limestone.

Erosion. The wearing away of the land surface by wind (sandblast) running water, and other geological agents.

Glacial till. Nonsorted, nonstratified sediment carried or deposited by a glacier.

Horizon, soil A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of 1, 2, and 3. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Humus. The well-decomposed, more or less stable part of the organic matter in mineral soils.

Massive. Large uniform masses of cohesive soil, in some places with ill-defined and irregular breakage, as in some of the fine-textured alluvial soils; structureless.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical mineralogical, and biological properties of the various horizons, and their thickness and arrangement in the soil profile.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Muck. An organic soil consisting of fairly well decomposed organic material that is relatively high in mineral content, finely divided, and dark in color.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Natural soil drainage. Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and in Podzolic soils commonly have mottlings below 6 to 16 inches, in the lower A horizon and in the B and C horizons.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Neutral, soil. See Reaction, soil.

Peat. Unconsolidated soil material, largely undecomposed organic matter, that has accumulated where there has been excess moisture.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

pH value. A numerical means for designating relatively weak acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		pH
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. If two sequa are present in a single soil profile, it is said to have a bisequum.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil variant. A soil having properties sufficiently different from those of other known soils to suggest establishing a new soil series, but a soil of such limited known area that creation of a new series is not believed to be justified.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated, *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsidence. Depression or lowering of the surface of a soil as the result of oxidation, drying, or compaction.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surplus runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt loam*, *silt*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Upland. Land that lies above the stream terraces and that is underlain by bedrock at fairly shallow depths; generally all areas that are not on terraces or bottom land.

Water table. The highest part of the soil or underlying rock-material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Weathering. The physical and chemical disintegration and decomposition of rocks and minerals. Soil is the result of weathering and other chemical, physical, and biological alterations that have changed the upper part of the earth's crust through various periods of time.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the soil series to which the mapping unit belongs. In referring to a capability unit, a woodland group, a recreation group, or a wildlife group, read the introduction to the section it is in for general information about its management. Other information is given in tables as follows:

Predicted yields, table 1, p. 16.
Recreation groups, table 2, p. 20.
Wildlife groups, table 3, p. 24.

Engineering uses of the soils, tables 4, 5, and 6, pp. 28 through 55.
Acreage and extent, table 7, p. 58.

Map symbol	Mapping unit	Described on page	Capability unit		Woodland group		Recreation group	Wildlife group
			Symbol	Page	Number	Page	Number	Number
Ak	Adrian mucky peat	59	IVw-1	14	10	19	1	2
Am	Alluvial land	59	IIw-4	13	1	18	4	5
AtA	Ashkum silty clay loam, 0 to 3 percent slopes	60	IIw-1	12	7	19	3	2
AzA	Aztalan loam, 0 to 2 percent slopes	60	IIw-2	13	7	19	4	2
AzB	Aztalan loam, 2 to 6 percent slopes	60	IIw-2	13	7	19	4	2
BmB	Boyer loamy sand, 2 to 6 percent slopes	61	IIIs-1	14	3	18	5	4
BmC	Boyer loamy sand, 6 to 12 percent slopes	61	IIIe-2	13	3	18	5	4
BnA	Boyer sandy loam, 0 to 2 percent slopes	61	IIIs-1	14	3	18	6	4
BnB	Boyer sandy loam, 2 to 6 percent slopes	61	IIIs-1	14	5	18	6	4
BrC2	Boyer complex, 6 to 12 percent slopes, eroded	61	IIIe-2	13	4	18	5	4
BrE2	Boyer complex, 12 to 30 percent slopes, eroded	61	VIe-1	14	4	18	5	4
BsA	Brookston silt loam, 0 to 3 percent slopes	62	IIw-1	12	7	19	3	2
CcB2	Casco sandy loam, 2 to 6 percent slopes, eroded	63	IIIe-2	13	5	18	6	4
CcC2	Casco sandy loam, 6 to 12 percent slopes, eroded	63	IVe-2	14	5	18	6	4
CeA	Casco loam, 0 to 2 percent slopes	63	IIIs-1	14	5	18	9	4
CeB2	Casco loam, 2 to 6 percent slopes, eroded	63	IIIe-2	13	5	18	9	4
CeC2	Casco loam, 6 to 12 percent slopes, eroded	63	IVe-2	14	5	18	9	4
CeD2	Casco loam, 12 to 20 percent slopes, eroded	63	VIe-2	14	5	18	9	4
CkC2	Casco-Fox loams, 6 to 12 percent slopes, eroded	63	IVe-2	14	1	18	9	4
CrC2	Casco-Rodman complex, 6 to 12 percent slopes, eroded	64	IVe-2	14	5	18	5	4
CrD2	Casco-Rodman complex, 12 to 20 percent slopes, eroded	64	VIe-2	14	5	18	5	4
CrE	Casco-Rodman complex, 20 to 35 percent slopes	64	VIIe-1	15	5	18	5	4
Cw	Colwood silt loam	65	IIw-3	13	7	19	3	2
DaA	Darroch fine sandy loam, neutral variant, 0 to 3 percent slopes	66	IIw-2	13	7	19	11	6
DdA	Dodge silt loam, 0 to 2 percent slopes	66	I-1	12	1	18	2	1
DdB	Dodge silt loam, 2 to 6 percent slopes	66	IIe-1	12	1	18	2	1
DsA	Dresden silt loam, 1 to 3 percent slopes	67	IIs-1	13	1	18	4	1
Dt	Drummer silt loam, gravelly substratum	67	IIw-2	13	7	19	3	2
FaA	Fabius loam, 1 to 3 percent slopes	68	IIw-3	13	7	19	4	6
FsA	Fox silt loam, 0 to 2 percent slopes	68	IIs-1	13	1	18	2	1
FsB	Fox silt loam, 2 to 6 percent slopes	68	IIe-2	12	1	18	2	1
GfA	Granby fine sandy loam, 0 to 3 percent slopes	69	IVw-1	14	7	19	10	5
GrA	Grays silt loam, 0 to 2 percent slopes	69	I-1	12	1	18	8	1
GrB	Grays silt loam, 2 to 6 percent slopes	69	IIe-1	12	1	18	8	1
HeA	Hebron loam, 0 to 2 percent slopes	70	IIs-2	13	2	18	6	1
HeB	Hebron loam, 2 to 6 percent slopes	70	IIe-3	12	2	18	6	1
HmB	Hochheim loam, 2 to 6 percent slopes	71	IIe-1	12	1	18	2	1
HmB2	Hochheim loam, 2 to 6 percent slopes, eroded	71	IIe-1	12	1	18	2	1

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit		Woodland group		Recreation group	Wildlife group
			Symbol	Page	Number	Page	Number	Number
HmC2	Hochheim loam, 6 to 12 percent slopes, eroded	71	IIIe-1	13	1	18	2	1
HmD2	Hochheim loam, 12 to 20 percent slopes, eroded	71	IVe-1	14	1	18	2	1
HmE	Hochheim loam, 20 to 30 percent slopes	71	VIe-1	14	1	18	2	1
HnA	Hochheim silt loam, 0 to 2 percent slopes	71	I-1	12	1	18	2	1
HoC3	Hochheim soils, 6 to 12 percent slopes, severely eroded	72	IVe-1	14	1	18	2	1
HoD3	Hochheim soils, 12 to 20 percent slopes, severely eroded	72	VIe-1	14	1	18	2	1
HrD	Hochheim-Hennepin complex, 12 to 20 percent slopes	72	IVe-1	14	5	18	13	4
HrE	Hochheim-Hennepin complex, 20 to 30 percent slopes	72	VIe-1	14	5	18	13	4
HrF	Hochheim-Hennepin complex, 30 to 45 percent slopes	73	VIIe-1	15	5	18	13	4
Hu	Houghton mucky peat	73	IIIw-1	14	10	19	1	2
Hv	Houghton peat, acid variant	74	VIIIw-1	15	10	19	1	7
JuA	Juneau silt loam, 1 to 3 percent slopes	74	I-1	12	1	18	4	1
KlA	Kendall silt loam, 1 to 3 percent slopes	75	IIw-2	13	7	19	4	3
Km	Keowns silt loam	75	IVw-1	14	7	19	3	2
KwB	Knowles silt loam, 1 to 6 percent slopes	76	IIe-2	12	1	18	8	1
KwC2	Knowles silt loam, 6 to 12 percent slopes, eroded	76	IIIe-2	13	1	18	8	1
LmA	Lamartine silt loam, 1 to 3 percent slopes	76	IIw-2	13	7	19	4	3
Lu	Loamy land	76	VIIIs-1	15	11	19	13	(1/)
Mf	Marsh	77	VIIIw-1	15	11	19	1	7
MgA	Martinton silt loam, 1 to 3 percent slopes	77	IIw-2	13	7	19	4	3
MmA	Matherton silt loam, 1 to 3 percent slopes	78	IIw-3	13	7	19	4	3
MoA	Mayville silt loam, 0 to 2 percent slopes	78	I-1	12	1	18	8	1
MoB	Mayville silt loam, 2 to 6 percent slopes	78	IIe-1	12	1	18	8	1
MtA	Mequon silt loam, 1 to 3 percent slopes	79	IIw-2	13	7	19	4	3
Mzb	Montgomery silty clay loam	79	IIw-1	12	7	19	3	2
MzfA	Mundelein silt loam, 1 to 3 percent slopes	80	IIw-2	13	7	19	4	6
MzkA	Mussey loam, 0 to 3 percent slopes	80	IIw-3	13	7	19	3	2
NnA	Nenno silt loam, 1 to 3 percent slopes	81	IIw-2	13	7	19	4	3
Ot	Otter silt loam	81	IIw-1	12	9	19	3	5
OuB	Ozaukee silt loam, 2 to 6 percent slopes	81	IIe-3	12	2	18	12	1
OuB2	Ozaukee silt loam, 2 to 6 percent slopes, eroded	82	IIe-3	12	2	18	12	1
OuC2	Ozaukee silt loam, 6 to 12 percent slopes, eroded	82	IIIe-3	14	2	18	12	1
OuD2	Ozaukee silt loam, 12 to 20 percent slopes, eroded	82	IVe-1	14	2	18	12	1
OuE	Ozaukee silt loam, 20 to 35 percent slopes	82	VIe-1	14	2	18	12	1
Pc	Palms mucky peat	83	IIw-4	13	10	19	1	2
Ph	Pella silt loam	83	IIw-1	12	7	19	3	2
RaA	Radford silt loam, 0 to 3 percent slopes	84	IIw-2	13	9	19	4	5
RkB	Ritchey silt loam, 2 to 6 percent slopes	84	IIIe-2	13	5	18	8	1
RkC2	Ritchey silt loam, 6 to 12 percent slopes, eroded	84	IVe-2	14	5	18	8	1
ScA	St. Charles silt loam, 0 to 2 percent slopes	89	I-1	12	1	18	7	1
ScB	St. Charles silt loam, 2 to 6 percent slopes	89	IIe-1	12	1	18	7	1
SeA	St. Charles silt loam, gravelly substratum, 0 to 2 percent slopes	89	I-1	12	1	18	2	1
SeB	St. Charles silt loam, gravelly substratum, 2 to 6 percent slopes	89	IIe-1	12	1	18	2	1
Sf	Sandy and gravelly land	85	VIIIs-1	15	11	19	13	(1/)

Map symbol	Mapping unit	Described on page	Capability unit		Woodland group		Recreation group	Wildlife group
			Symbol	Page	Number	Page	Number	Number
ShA	Saylesville silt loam, 0 to 2 percent slopes-	86	IIs-2	13	2	18	12	1
ShB	Saylesville silt loam, 2 to 6 percent slopes-	86	IIe-3	12	2	18	12	1
Sm	Sebewa silt loam----------	86	IIw-3	13	7	19	3	2
SrB	Sisson fine sandy loam, 2 to 6 percent slopes----------	87	IIe-2	12	3	18	7	1
SrC2	Sisson fine sandy loam, 6 to 12 percent slopes, eroded----------	87	IIIe-2	13	3	18	7	1
SrD2	Sisson fine sandy loam, 12 to 20 percent slopes, eroded----------	87	IVe-1	14	3	18	7	1
SvA	Sisson-Casco-Hochheim complex, 0 to 2 percent slopes----------	87	I-1	12	1	18	7	1
SvB2	Sisson-Casco-Hochheim complex, 2 to 6 percent slopes, eroded----------	87	IIe-1	12	1	18	7	1
SvC2	Sisson-Casco-Hochheim complex, 6 to 12 percent slopes----------	87	IIIe-1	13	1	18	7	1
SvD2	Sisson-Casco-Hochheim complex, 12 to 20 percent slopes, eroded----------	88	IVe-1	14	1	18	7	1
SvE	Sisson-Casco-Hochheim complex, 20 to 30 percent slopes----------	88	VIe-1	14	1	18	7	1
ThA	Theresa silt loam, 0 to 2 percent slopes-----	90	I-1	12	1	18	2	1
ThB	Theresa silt loam, 2 to 6 percent slopes-----	90	IIe-1	12	1	18	2	1
ThB2	Theresa silt loam, 2 to 6 percent slopes, eroded----------	90	IIe-1	12	1	18	2	1
ThC2	Theresa silt loam, 6 to 12 percent slopes, eroded----------	91	IIIe-1	13	1	18	2	1
VsA	Virgil silt loam, gravelly substratum, 0 to 3 percent slopes----------	92	IIw-3	13	7	19	4	3
Wa	Wallkill silt loam----------	93	IIw-4	13	10	19	10	5
WmA	Wasepi sandy loam, 1 to 3 percent slopes-----	93	IVw-1	14	7	19	11	6
Ww	Wet alluvial land----------	93	VIIIw-1	15	9	19	3	7
YrA	Yahara silt loam, 1 to 3 percent slopes------	94	IIw-3	13	7	19	4	6
ZuA	Zurich silt loam, 0 to 2 percent slopes------	95	I-1	12	1	18	7	1
ZuB	Zurich silt loam, 2 to 6 percent slopes------	95	IIe-1	12	1	18	7	1
ZuB2	Zurich silt loam, 2 to 6 percent slopes, eroded----------	95	IIe-1	12	1	18	7	1
ZuC2	Zurich silt loam, 6 to 12 percent slopes, eroded----------	95	IIIe-1	13	1	18	7	1

1/ Not placed in wildlife group.

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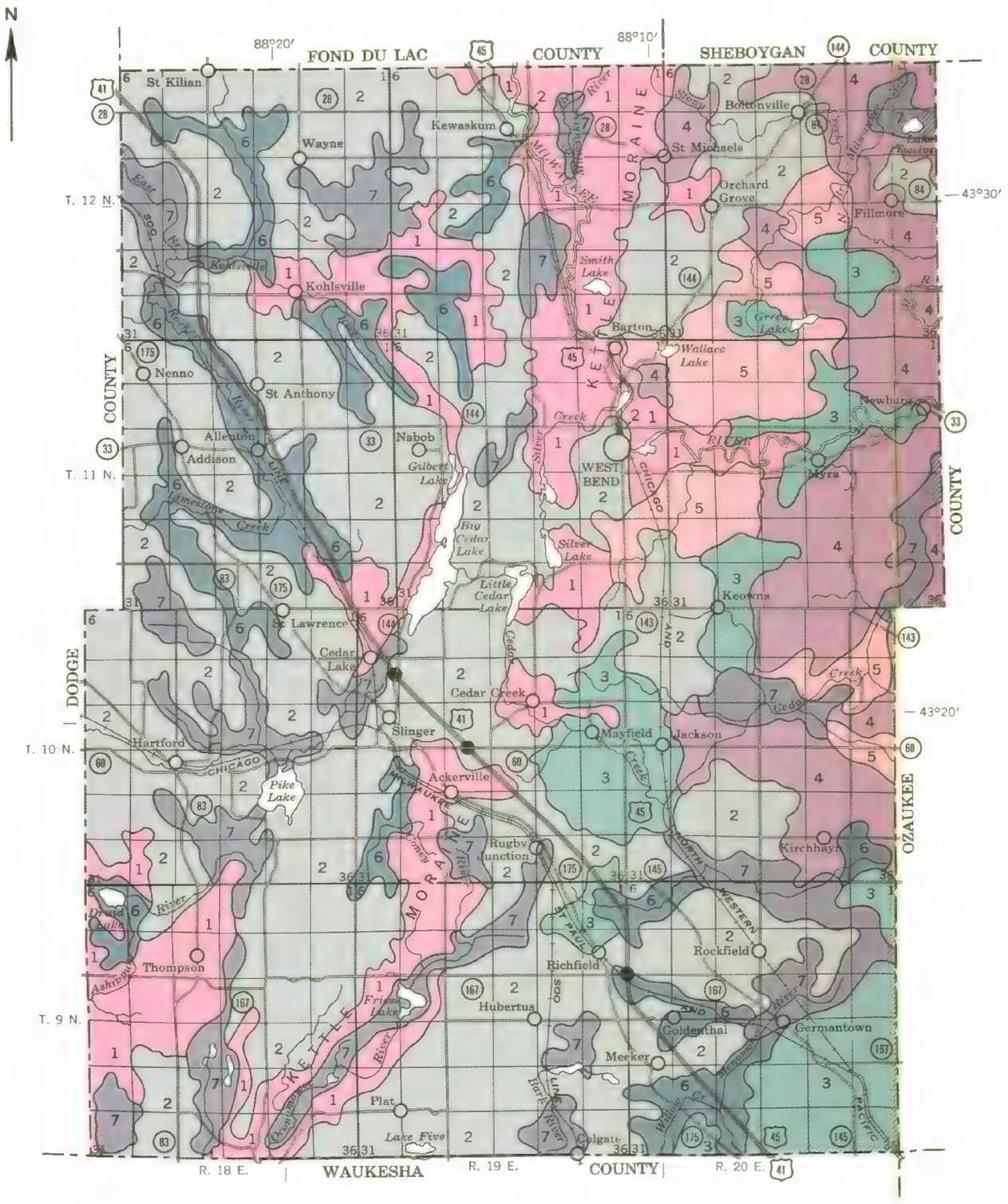


U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
UNIVERSITY OF WISCONSIN,
WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY,
SOILS DEPARTMENT, AND WISCONSIN AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

WASHINGTON COUNTY, WISCONSIN

Scale 1:190 080

1 0 1 2 3 4 Miles

SOIL ASSOCIATIONS

1 — Casco-Fox-Rodman association: Well-drained to excessively drained soils that have a subsoil of gravelly sandy loam to clay loam; very shallow to moderately deep over gravel and sand, on outwash terraces

2 — Hochheim-Theresa association: Well-drained soils that have a subsoil of clay loam; formed in loess and the underlying sandy loam to loam glacial till, on uplands

3 — Ozaukee-Martinton-Saylesville association: Well-drained and somewhat poorly drained soils that have a subsoil of silty clay loam to clay; over silty clay loam glacial till or lake-laid silt and clay, on ground moraines and lacustrine basins

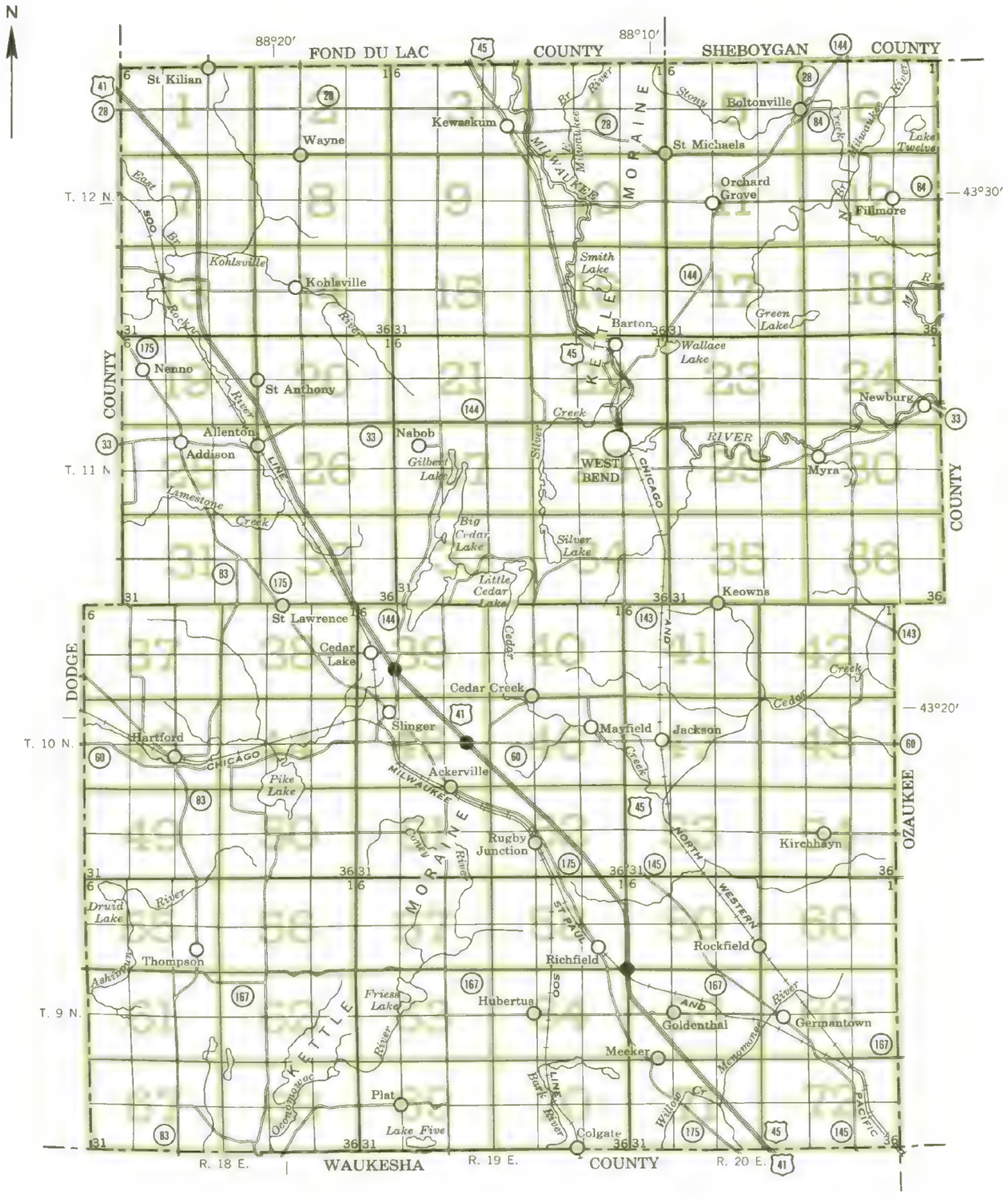
4 — Casco-Hochheim-Sisson association: Well-drained soils that have a subsoil of loam to clay loam; over lake-laid silt and fine sand, in gravel and sand outwash, or in sandy loam glacial till, on uplands

5 — Colwood-Boyer-Sisson association: Well-drained and poorly drained soils that have a subsoil of sandy loam or silty clay loam; over lake-laid silt and fine sand or gravel and sand outwash, on plains and dissected terraces

6 — Brookston-Pella-Lamartine association: Somewhat poorly drained and poorly drained soils that have a subsoil of clay loam or silty clay loam; formed in loess and underlying loam to sandy loam glacial till

7 — Houghton-Palms-Adrian association: Very poorly drained organic soils along drainageways, in depressions, and in old lakebeds

September 1969



INDEX TO MAP SHEETS

WASHINGTON COUNTY, WISCONSIN

Scale 1:190 080

1 0 1 2 3 4 Miles

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

WASHINGTON COUNTY, WISCONSIN

UNIVERSITY OF WISCONSIN
WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY, SOILS DEPARTMENT
WISCONSIN AGRICULTURAL EXPERIMENT STATION

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, or F, shows the slope. Most symbols without a slope letter are those of nearly level soils or land types, but some are for soils or land types that have a considerable range in slope. The final number, 2 or 3, in a symbol indicates that the soil is eroded or severely eroded.

SYMBOL	NAME
Ak	Adrian mucky peat
Am	Alluvial land
AtA	Ashkum silty clay loam, 0 to 3 percent slopes
AzA	Aztalan loam, 0 to 2 percent slopes
AzB	Aztalan loam, 2 to 6 percent slopes
BmB	Boyer loamy sand, 2 to 6 percent slopes
BmC	Boyer loamy sand, 6 to 12 percent slopes
BnA	Boyer sandy loam, 0 to 2 percent slopes
BnB	Boyer sandy loam, 2 to 6 percent slopes
BrC2	Boyer complex, 6 to 12 percent slopes, eroded
BrE2	Boyer complex, 12 to 30 percent slopes, eroded
BsA	Brookston silt loam, 0 to 3 percent slopes
CcB2	Casco sandy loam, 2 to 6 percent slopes, eroded
CcC2	Casco sandy loam, 6 to 12 percent slopes, eroded
CeA	Casco loam, 0 to 2 percent slopes
CeB2	Casco loam, 2 to 6 percent slopes, eroded
CeC2	Casco loam, 6 to 12 percent slopes, eroded
CeD2	Casco loam, 12 to 20 percent slopes, eroded
CkC2	Casco-Fox loams, 6 to 12 percent slopes, eroded
CrC2	Casco-Rodman complex, 6 to 12 percent slopes, eroded
CrD2	Casco-Rodman complex, 12 to 20 percent slopes, eroded
CrE	Casco-Rodman complex, 20 to 35 percent slopes
Cw	Colwood silt loam
DaA	Darroch fine sandy loam, neutral variant, 0 to 3 percent slopes
DdA	Dodge silt loam, 0 to 2 percent slopes
DdB	Dodge silt loam, 2 to 6 percent slopes
DsA	Dresden silt loam, 1 to 3 percent slopes
Dt	Drummer silt loam, gravelly substratum
FaA	Fabius loam, 1 to 3 percent slopes
FsA	Fox silt loam, 0 to 2 percent slopes
FsB	Fox silt loam, 2 to 6 percent slopes
GfA	Granby fine sandy loam, 0 to 3 percent slopes
GrA	Grays silt loam, 0 to 2 percent slopes
GrB	Grays silt loam, 2 to 6 percent slopes
HeA	Hebron loam, 0 to 2 percent slopes
HeB	Hebron loam, 2 to 6 percent slopes
HmB	Hochheim loam, 2 to 6 percent slopes
HmB2	Hochheim loam, 2 to 6 percent slopes, eroded
HmC2	Hochheim loam, 6 to 12 percent slopes, eroded
HmD2	Hochheim loam, 12 to 20 percent slopes, eroded
HmE	Hochheim loam, 20 to 30 percent slopes
HnA	Hochheim silt loam, 0 to 2 percent slopes
HoC3	Hochheim soils, 6 to 12 percent slopes, severely eroded
HoD3	Hochheim soils, 12 to 20 percent slopes, severely eroded
HrD	Hochheim-Hennepin complex, 12 to 20 percent slopes
HrE	Hochheim-Hennepin complex, 20 to 30 percent slopes
HrF	Hochheim-Hennepin complex, 30 to 45 percent slopes
Hu	Houghton mucky peat
Hv	Houghton peat, acid variant
JuA	Juneau silt loam, 1 to 3 percent slopes
KlA	Kendall silt loam, 1 to 3 percent slopes
Km	Keowns silt loam
KwB	Knowles silt loam, 1 to 6 percent slopes
KwC2	Knowles silt loam, 6 to 12 percent slopes, eroded
LmA	Lamartine silt loam, 1 to 3 percent slopes
Lu	Loamy land
Mf	Marsh
MgA	Martinton silt loam, 1 to 3 percent slopes
MmA	Matherton silt loam, 1 to 3 percent slopes
MoA	Mayville silt loam, 0 to 2 percent slopes
MoB	Mayville silt loam, 2 to 6 percent slopes
MtA	Mequon silt loam, 1 to 3 percent slopes
Mzb	Montgomery silty clay loam
MzfA	Mundelein silt loam, 1 to 3 percent slopes
MzkA	Mussey loam, 0 to 3 percent slopes
NnA	Nenno silt loam, 1 to 3 percent slopes
Ot	Otter silt loam
OuB	Ozaukee silt loam, 2 to 6 percent slopes
OuB2	Ozaukee silt loam, 2 to 6 percent slopes, eroded
OuC2	Ozaukee silt loam, 6 to 12 percent slopes, eroded
OuD2	Ozaukee silt loam, 12 to 20 percent slopes, eroded
OuE	Ozaukee silt loam, 20 to 35 percent slopes
Pc	Palms mucky peat
Ph	Pella silt loam
RaA	Radford silt loam, 0 to 3 percent slopes
RkB	Ritchey silt loam, 2 to 6 percent slopes
RkC2	Ritchey silt loam, 6 to 12 percent slopes, eroded
ScA	St. Charles silt loam, 0 to 2 percent slopes
ScB	St. Charles silt loam, 2 to 6 percent slopes
SeA	St. Charles silt loam, gravelly substratum, 0 to 2 percent slopes
SeB	St. Charles silt loam, gravelly substratum, 2 to 6 percent slopes
Sf	Sandy and gravelly land
ShA	Saylesville silt loam, 0 to 2 percent slopes
ShB	Saylesville silt loam, 2 to 6 percent slopes
Sm	Sebewa silt loam
SrB	Sisson fine sandy loam, 2 to 6 percent slopes
SrC2	Sisson fine sandy loam, 6 to 12 percent slopes, eroded
SrD2	Sisson fine sandy loam, 12 to 20 percent slopes, eroded
SvA	Sisson-Casco-Hochheim complex, 0 to 2 percent slopes
SvB2	Sisson-Casco-Hochheim complex, 2 to 6 percent slopes, eroded
SvC2	Sisson-Casco-Hochheim complex, 6 to 12 percent slopes, eroded
SvD2	Sisson-Casco-Hochheim complex, 12 to 20 percent slopes, eroded
SvE	Sisson-Casco-Hochheim complex, 20 to 30 percent slopes
ThA	Theresa silt loam, 0 to 2 percent slopes
ThB	Theresa silt loam, 2 to 6 percent slopes
ThB2	Theresa silt loam, 2 to 6 percent slopes, eroded
ThC2	Theresa silt loam, 6 to 12 percent slopes, eroded
VsA	Virgil silt loam, gravelly substratum, 0 to 3 percent slopes
Wa	Wallkill silt loam
WmA	Wasepi sandy loam, 1 to 3 percent slopes
Ww	Wet alluvial land
YrA	Yahara silt loam, 1 to 3 percent slopes
ZuA	Zurich silt loam, 0 to 2 percent slopes
ZuB	Zurich silt loam, 2 to 6 percent slopes
ZuB2	Zurich silt loam, 2 to 6 percent slopes, eroded
ZuC2	Zurich silt loam, 6 to 12 percent slopes, eroded

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Dual
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Tunnel

Buildings
- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

BOUNDARIES

- National or state
- County
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
- Unclassified

Canals and ditches (CANAL)

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Alluvial fan

Drainage end

RELIEF

Escarpments
- Bedrock
- Other

Prominent peak

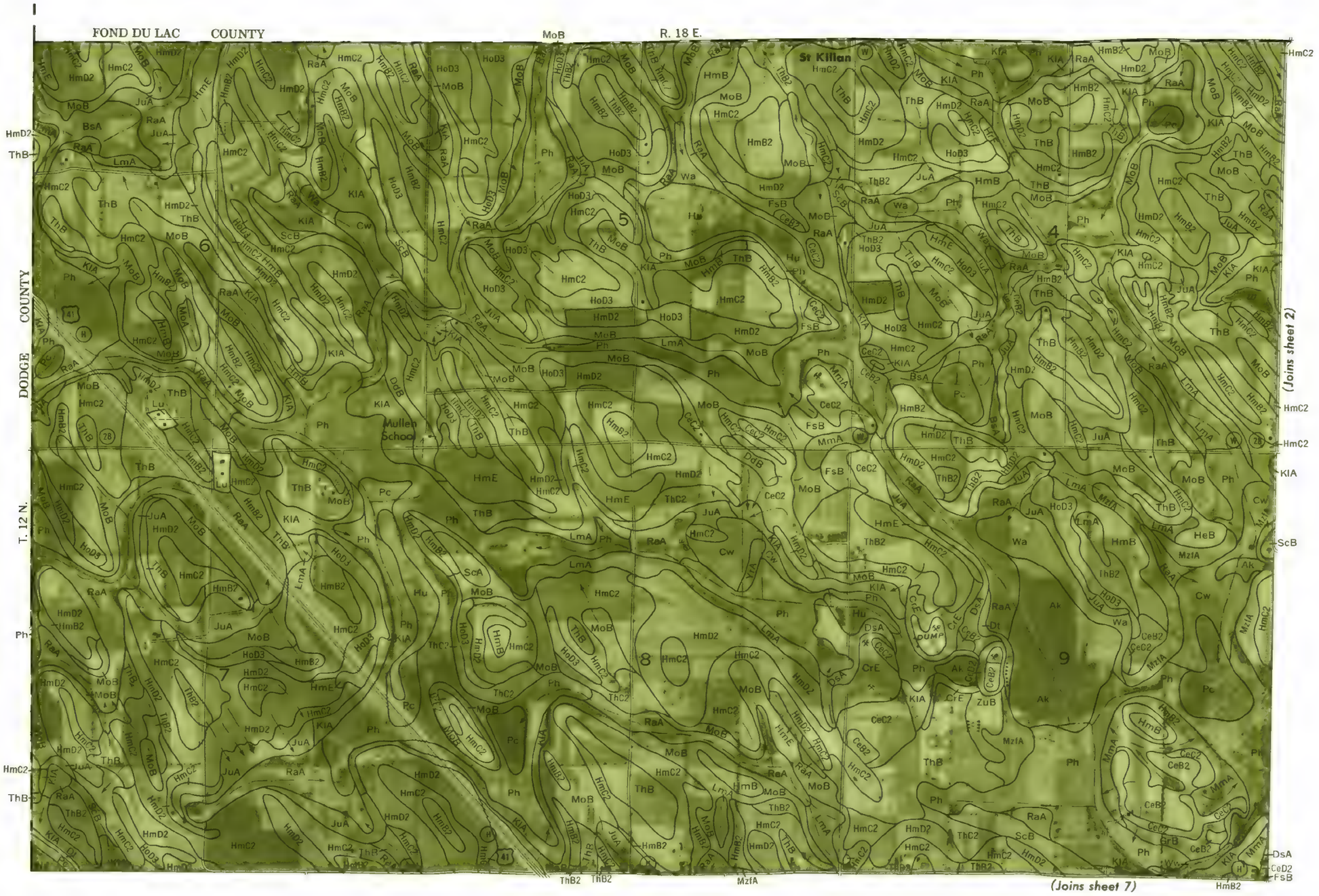
Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness
  - Stony
  - Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully

Soil map constructed 1969 by Cartographic Division, Soil Conservation Service, USDA, from 1964 aerial photographs. Controlled mosaic based on Wisconsin plane coordinate system, south zone, Lambert conformal conic projection, 1927 North American datum.



Scale 1:15840

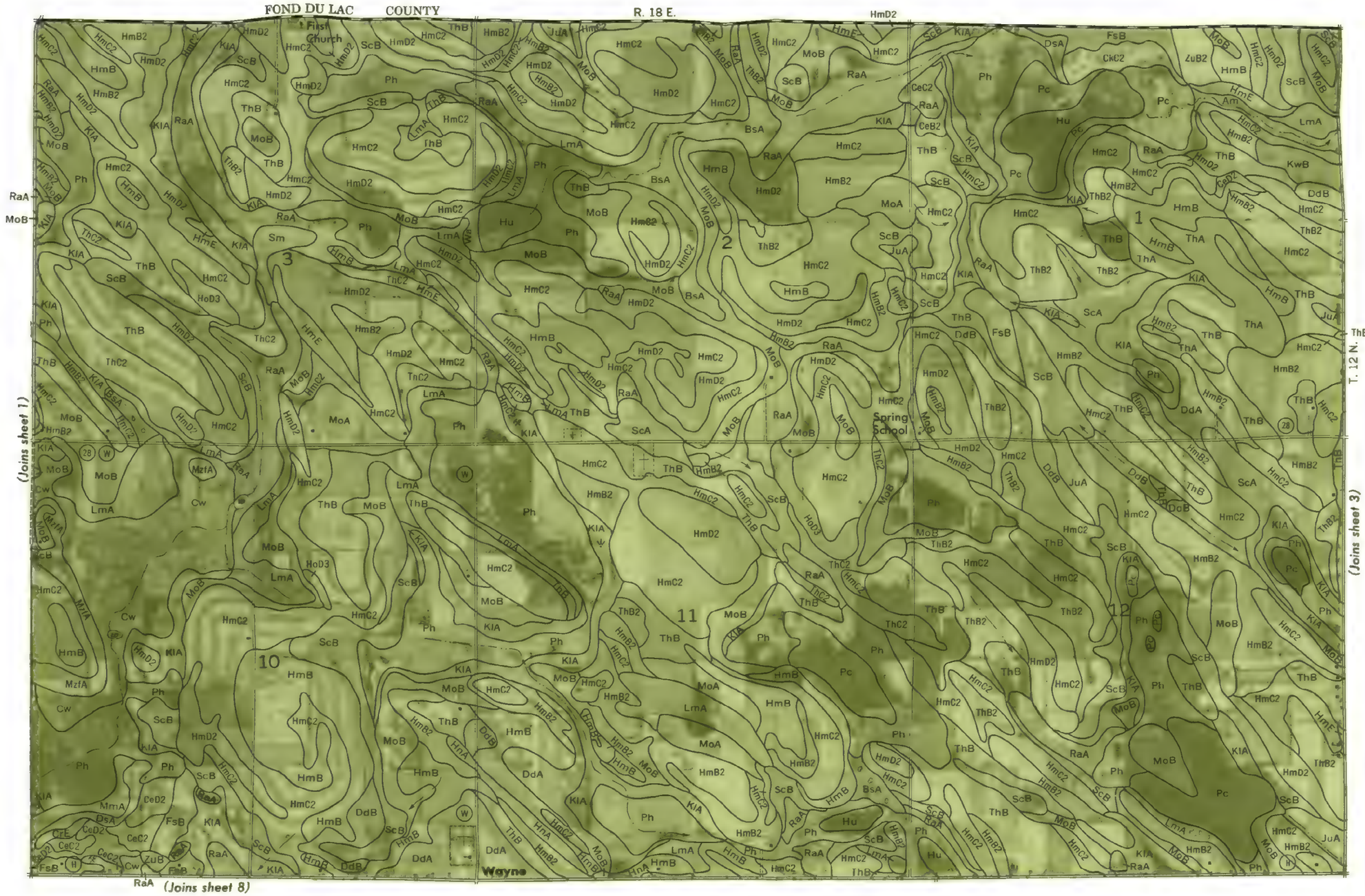
1 ¾ ½ ¼ 0 1 Mile

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station. Land division corners are approximately positioned on this map.

WASHINGTON COUNTY, WISCONSIN NO. 1

WASHINGTON COUNTY, WISCONSIN — SHEET NUMBER 2



Scale 1:15840

1 Mile 0 ⅛ ¼ ½ ¾ 1

5000 4000 3000 2000 1000 0 5000 Feet

WASHINGTON COUNTY, WISCONSIN NO. 2

Land division corners are approximately positioned on this map.

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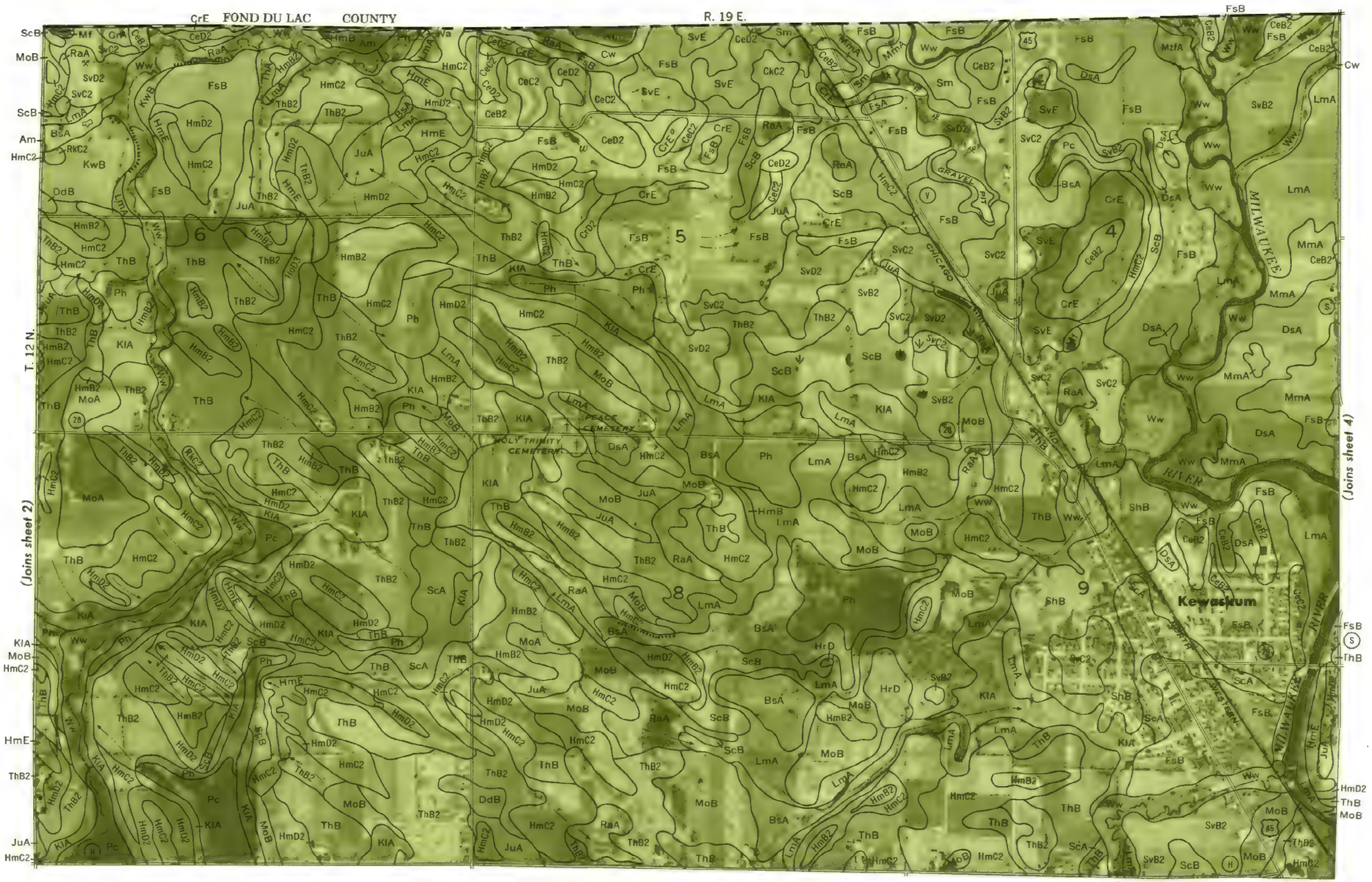

Scale 1:15840

1 Mile — 1 — ¾ — ½ — ¼ — 0

5000 — 4000 — 3000 — 2000 — 1000 — 0 — 5000 Feet

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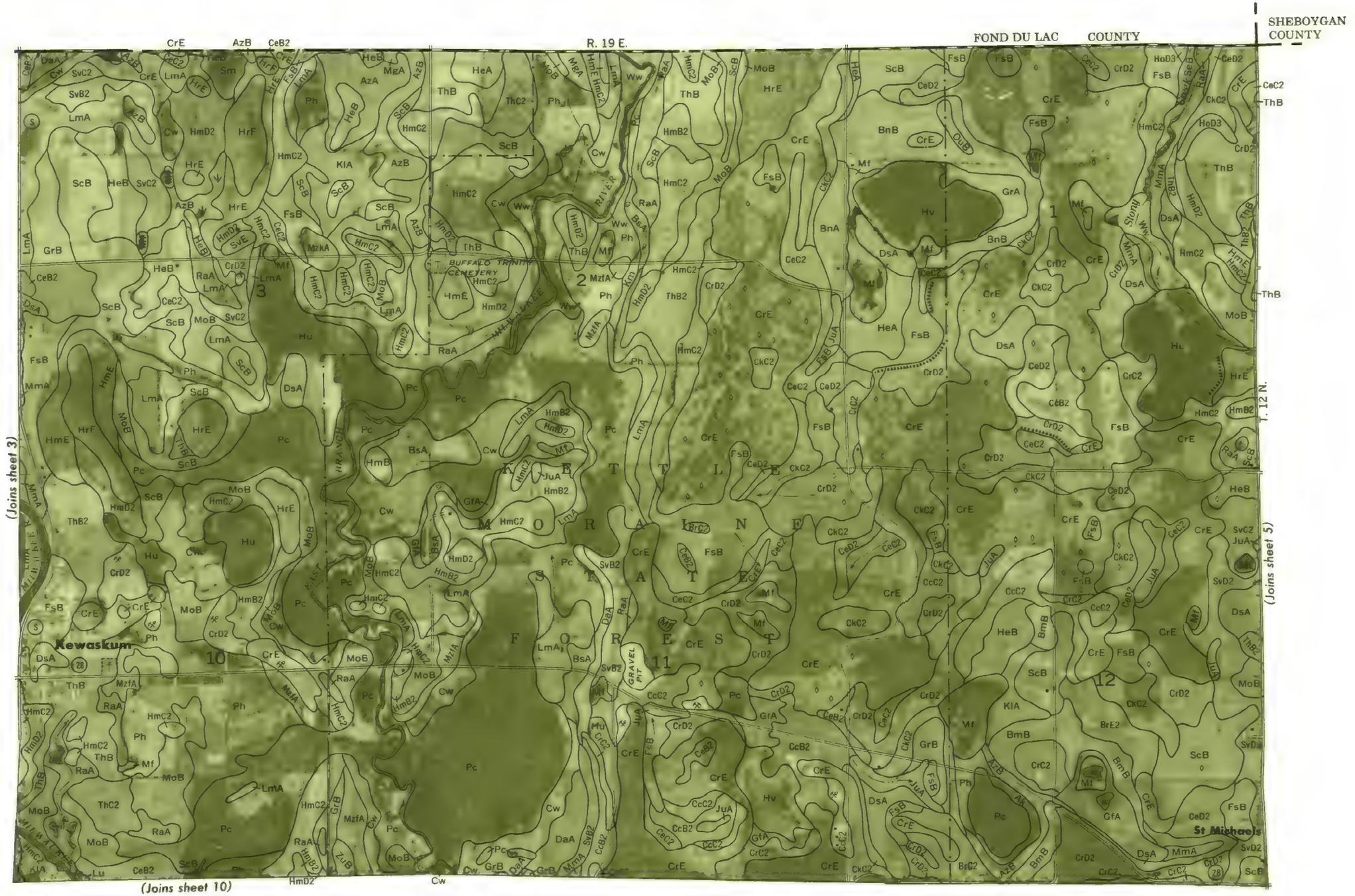
WASHINGTON COUNTY, WISCONSIN NO. 3

WASHINGTON COUNTY, WISCONSIN — SHEET NUMBER 4



Scale 1:15840

1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

WASHINGTON COUNTY, WISCONSIN NO. 4

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Land division corners are approximately positioned on this map.

WASHINGTON COUNTY, WISCONSIN NO. 5

FOND DU LAC COUNTY

SHEBOYGAN COUNTY

R. 20 E.

T. 12 N.

N

(Joins sheet 4)

(Joins sheet 6)

(Joins sheet 11)

Boltonville

St Michaels

St Johns Church

UNION CEMETERY

Creek

Scale 1:15840

1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:15840

1 Mile — ¾ — ½ — ¼ — 0

5000 — 4000 — 3000 — 2000 — 1000 — 0 — 5000 Feet

WASHINGTON COUNTY, WISCONSIN NO. 6

Land division corners are approximately positioned on this map.

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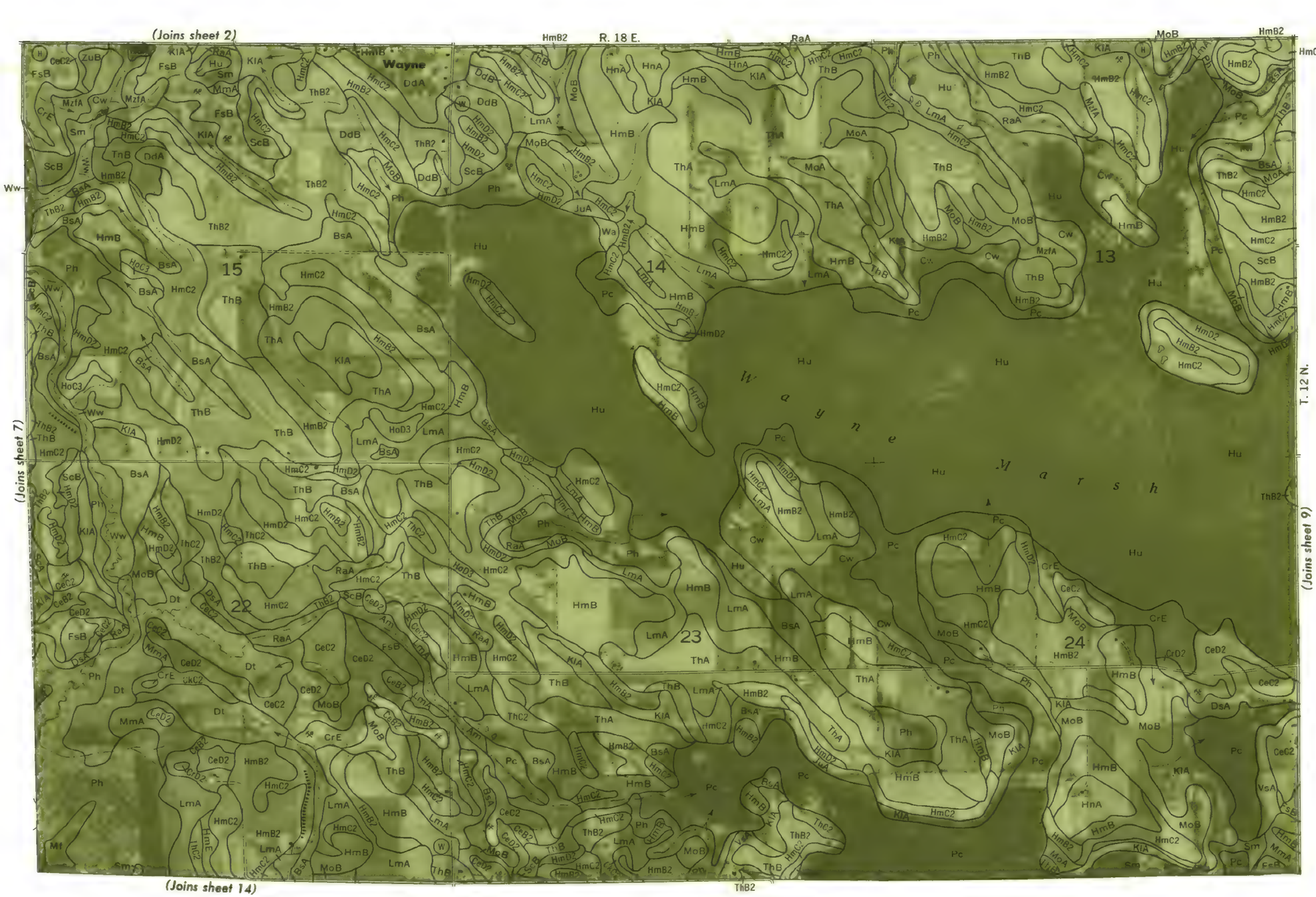
Land division corners are approximately positioned on this map.

WASHINGTON COUNTY, WISCONSIN NO. 7



Scale 1:15840

1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

WASHINGTON COUNTY, WISCONSIN NO. 8

Land division corners are approximately positioned on this map.

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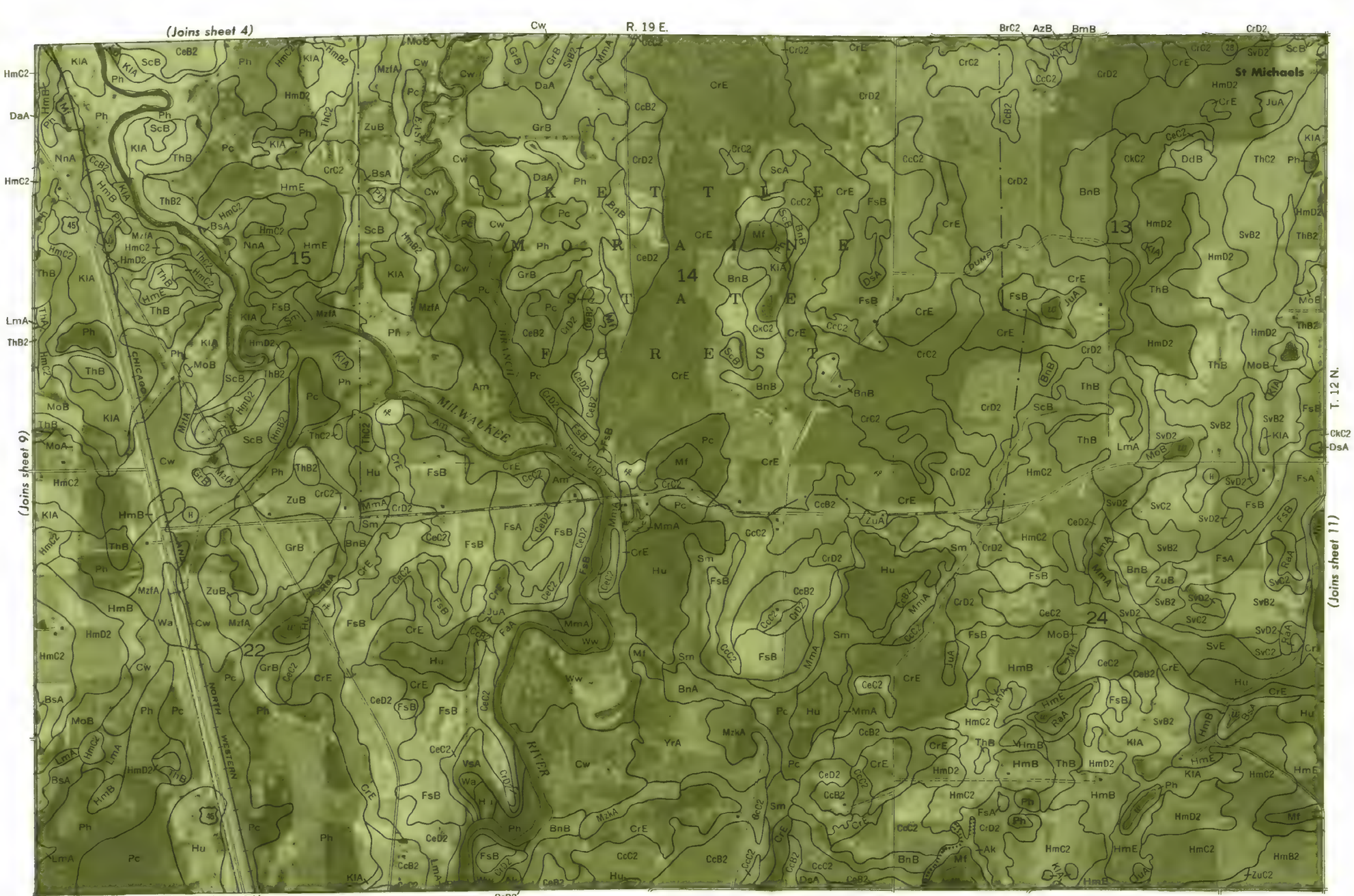
WASHINGTON COUNTY, WISCONSIN NO. 9

N

Scale 1:15840

1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet



Scale 1:15840

1 Mile 0 ¼ ½ ¾ 1

5000 Feet 0 1000 2000 3000 4000 5000

WASHINGTON COUNTY, WISCONSIN NO. 10

Land division corners are approximately positioned on this map.

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Land division corners are approximately positioned on this map.

WASHINGTON COUNTY, WISCONSIN NO. 11

N

R. 20 E.

T. 12 N.

(Joins sheet 5)

(Joins sheet 10)

(Joins sheet 12)

(Joins sheet 17)

St Michaels

Orchard Grove

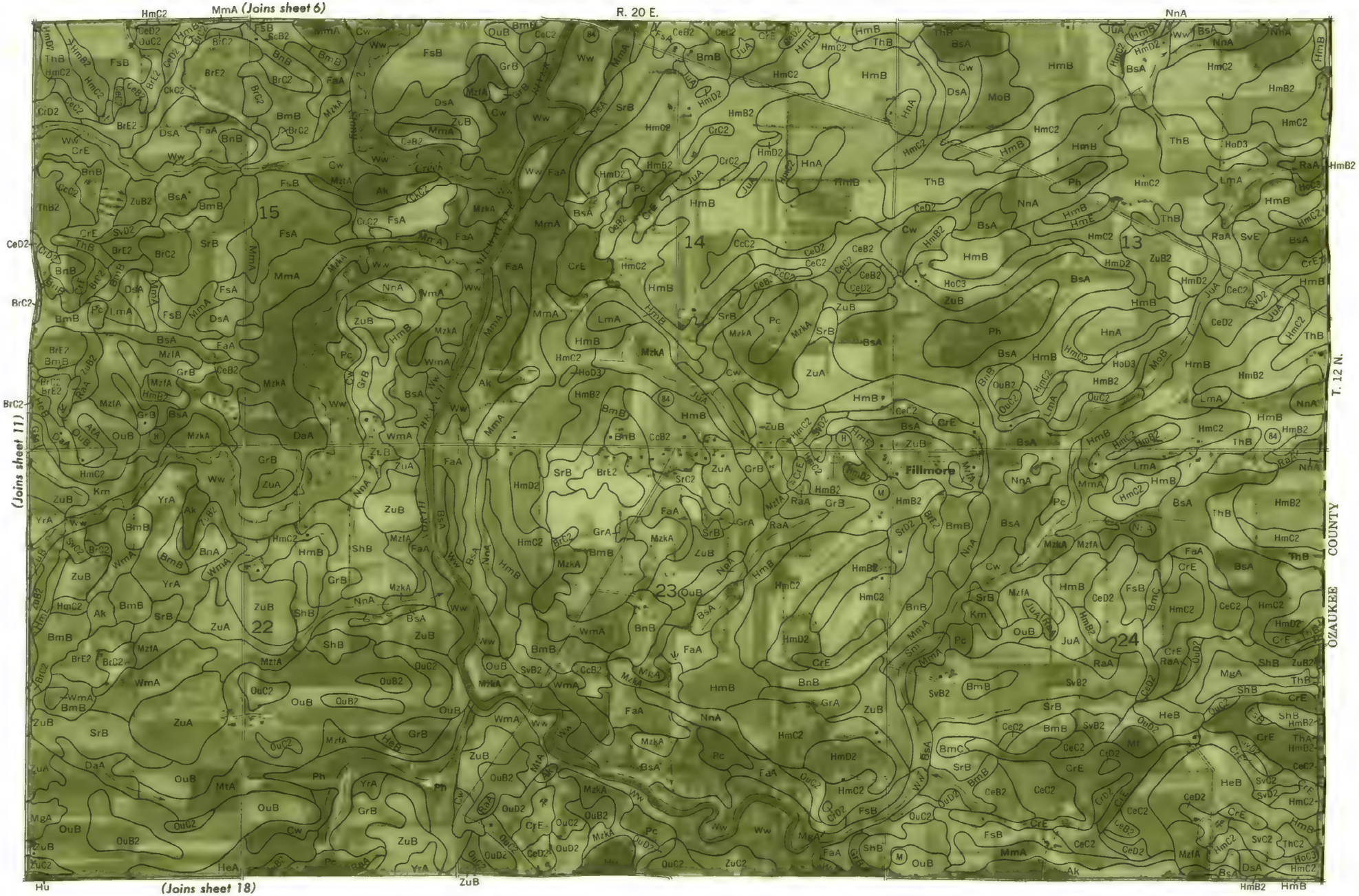
16 17 18 19 20 21

Scale 1:15840

1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

WASHINGTON COUNTY, WISCONSIN — SHEET NUMBER 12



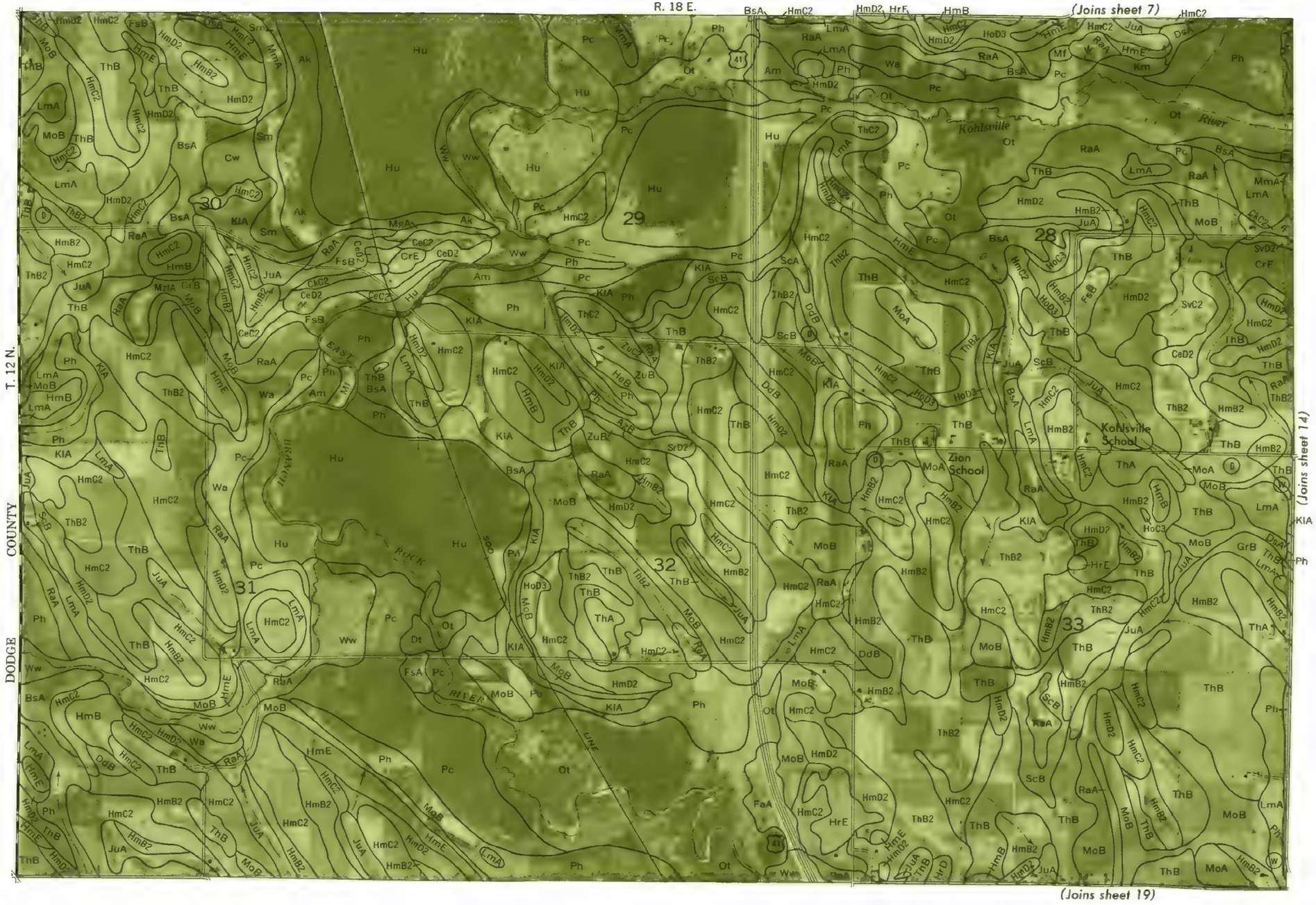
Scale 1:15840

1 Mile — 5000 Feet

WASHINGTON COUNTY, WISCONSIN NO. 12

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station



Scale 1:15840

1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5 000 Feet

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station.
Land division corners are approximately positioned on this map.

WASHINGTON COUNTY, WISCONSIN NO. 13

Scale 1:15840

1 Mile — 1 — ¾ — ½ — ¼ — 0

5 000 — 4 000 — 3 000 — 2 000 — 1 000 — 0 — 5 000 Feet

WASHINGTON COUNTY, WISCONSIN NO. 14

Land division corners are approximately positioned on this map.

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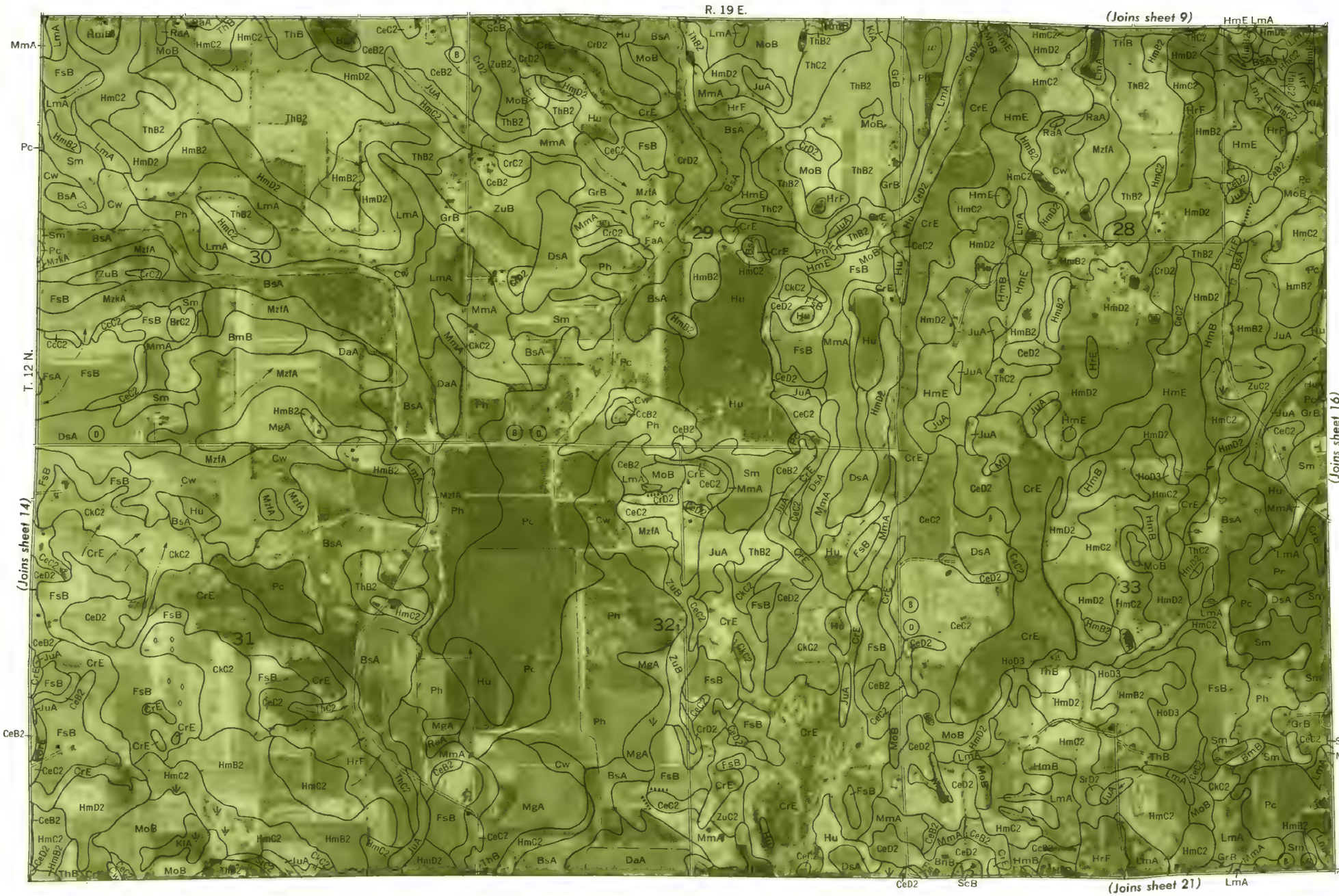
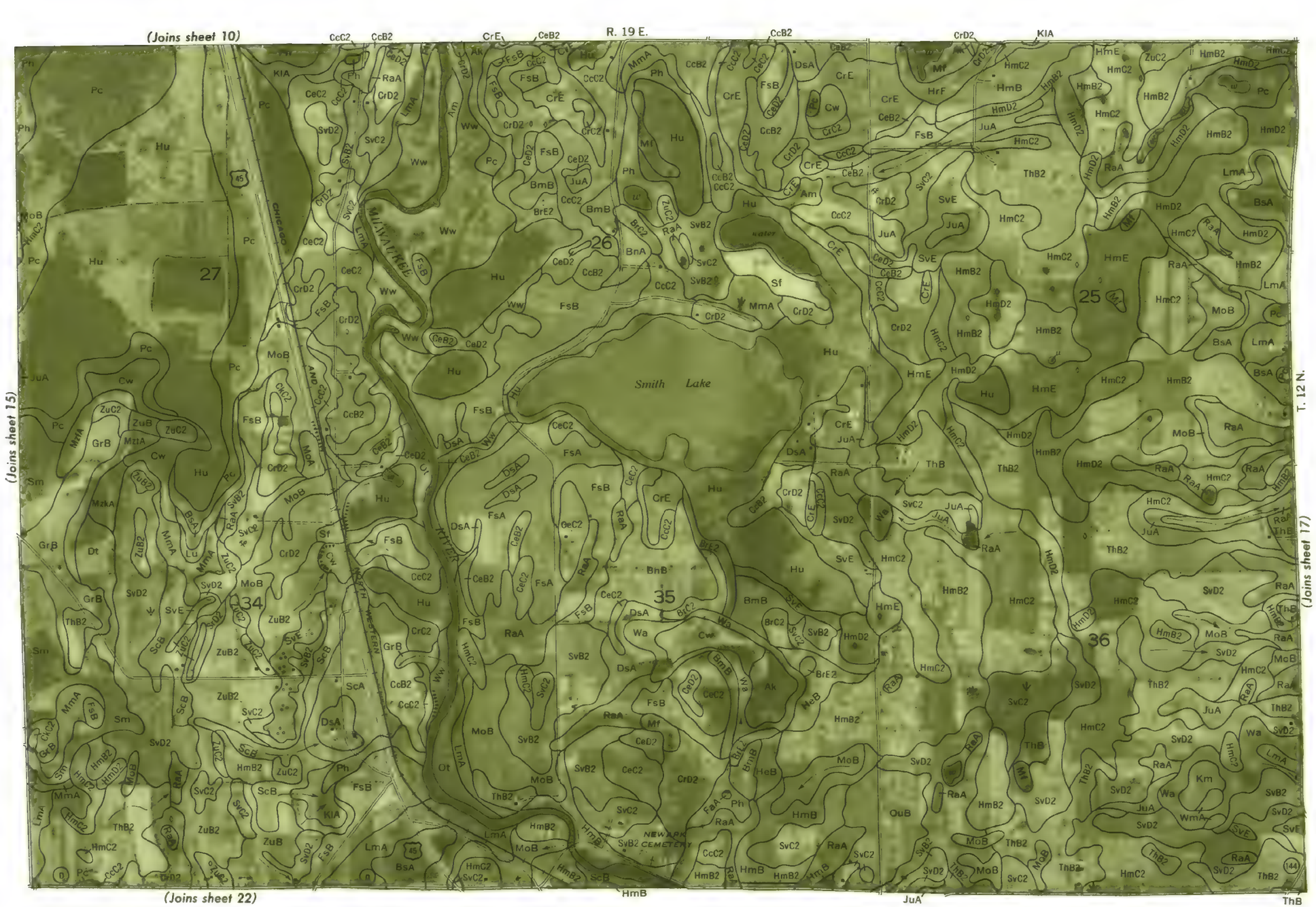
WASHINGTON COUNTY, WISCONSIN NO. 15



Scale 1:15840

1 Mile 0 ¼ ½ ¾ 1

5000 Feet 0 1000 2000 3000 4000 5000



Scale 1:15840

1 Mile — 5 000 Feet

WASHINGTON COUNTY, WISCONSIN NO. 16

Land division corners are approximately positioned on this map.

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Land division corners are approximately positioned on this map

WASHINGTON COUNTY, WISCONSIN NO. 17

Scale 1:15840

1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:15840

1 Mile — 5000 Feet

WASHINGTON COUNTY, WISCONSIN NO. 18

Land division corners are approximately positioned on this map.

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Land division corners are approximately positioned on this map.

WASHINGTON COUNTY, WISCONSIN NO. 19

N

T. 11 N.

R. 18 E.

DODGE COUNTY

Nenno

St Anthony

EAST BRANCH ROCK RIVER

(Joins sheet 13)

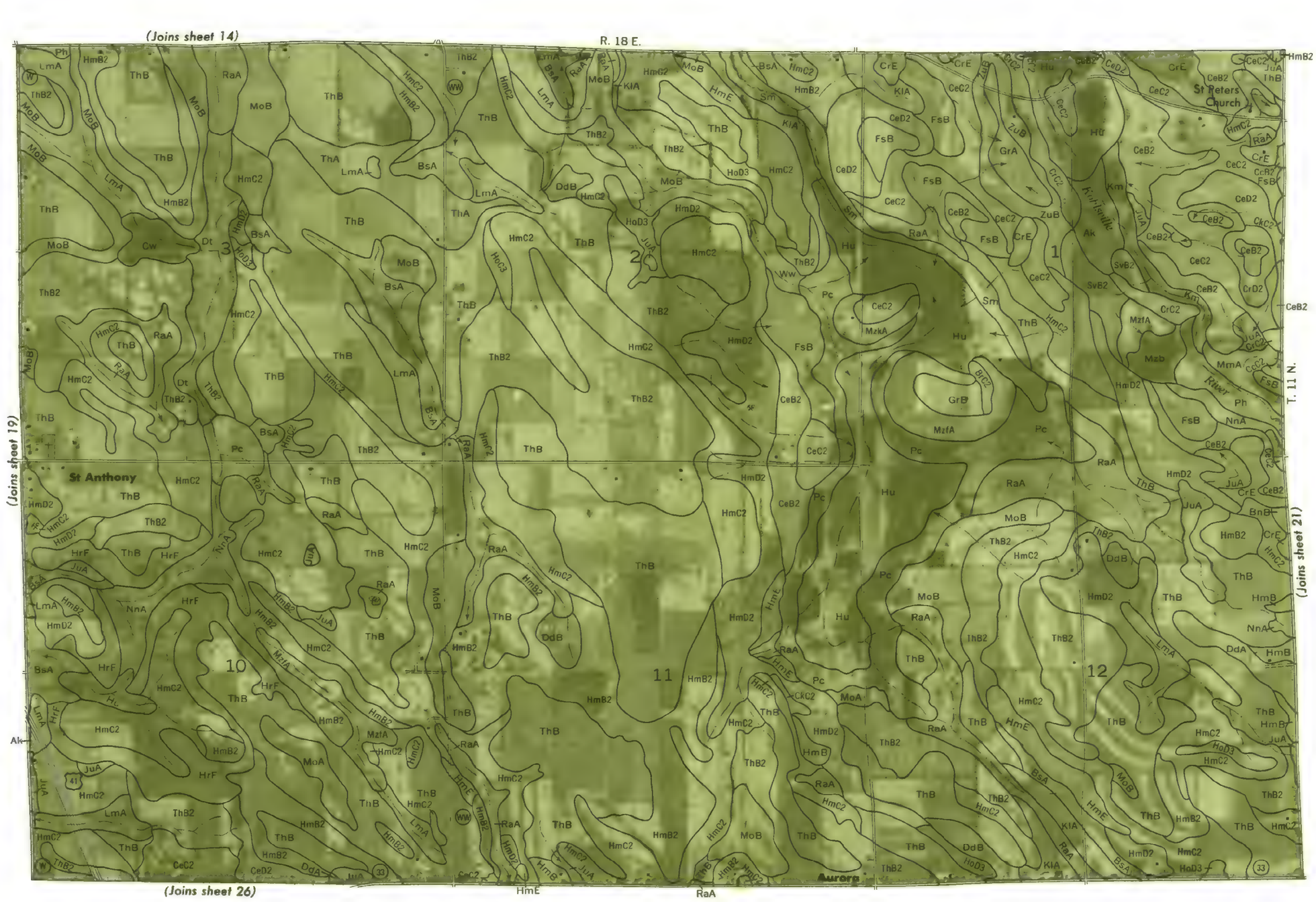
(Joins sheet 20)

(Joins sheet 25)

Scale 1:15840

1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet



Scale 1:15840

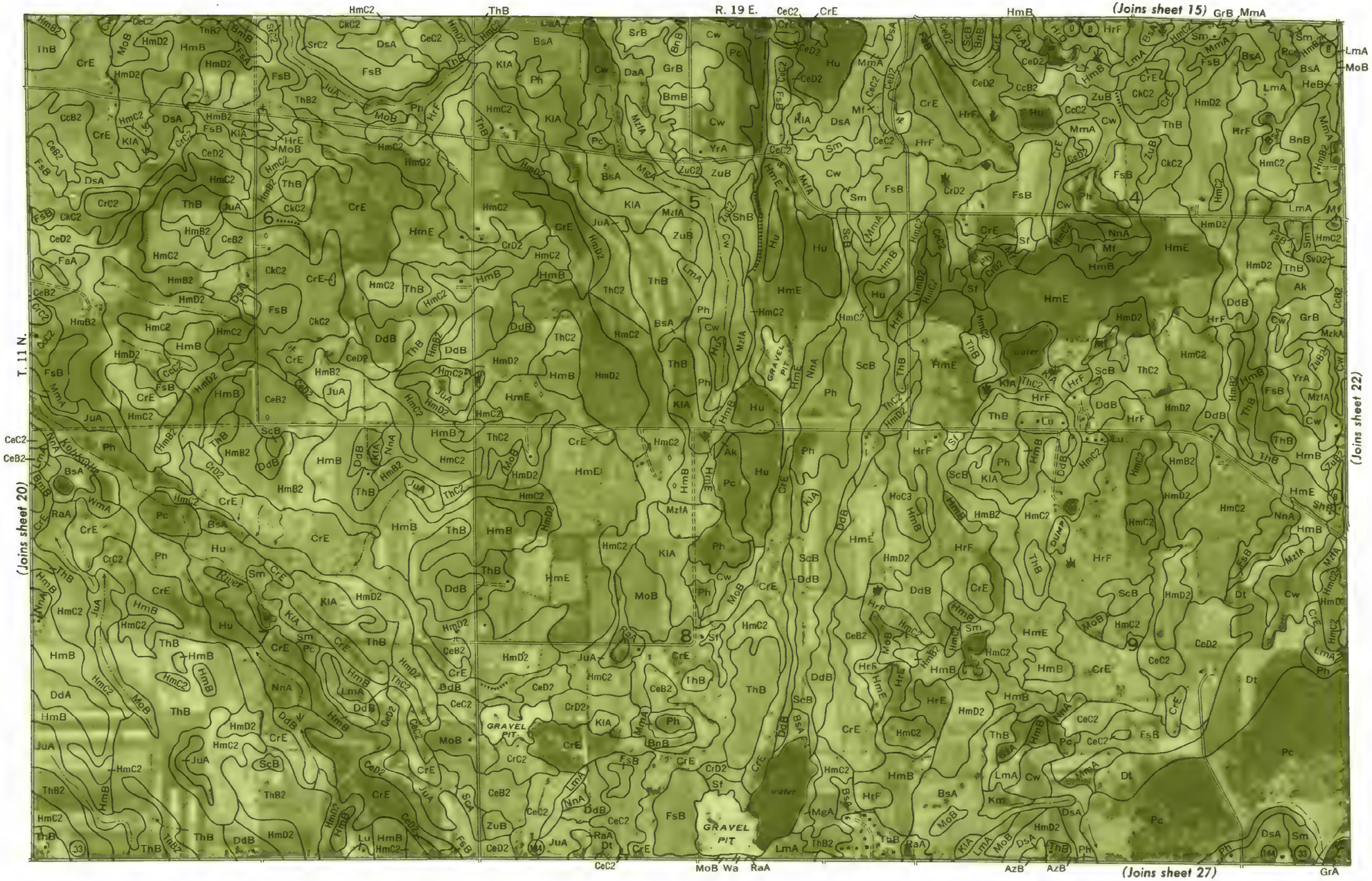
1 Mile 0 ¼ ½ ¾ 1

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

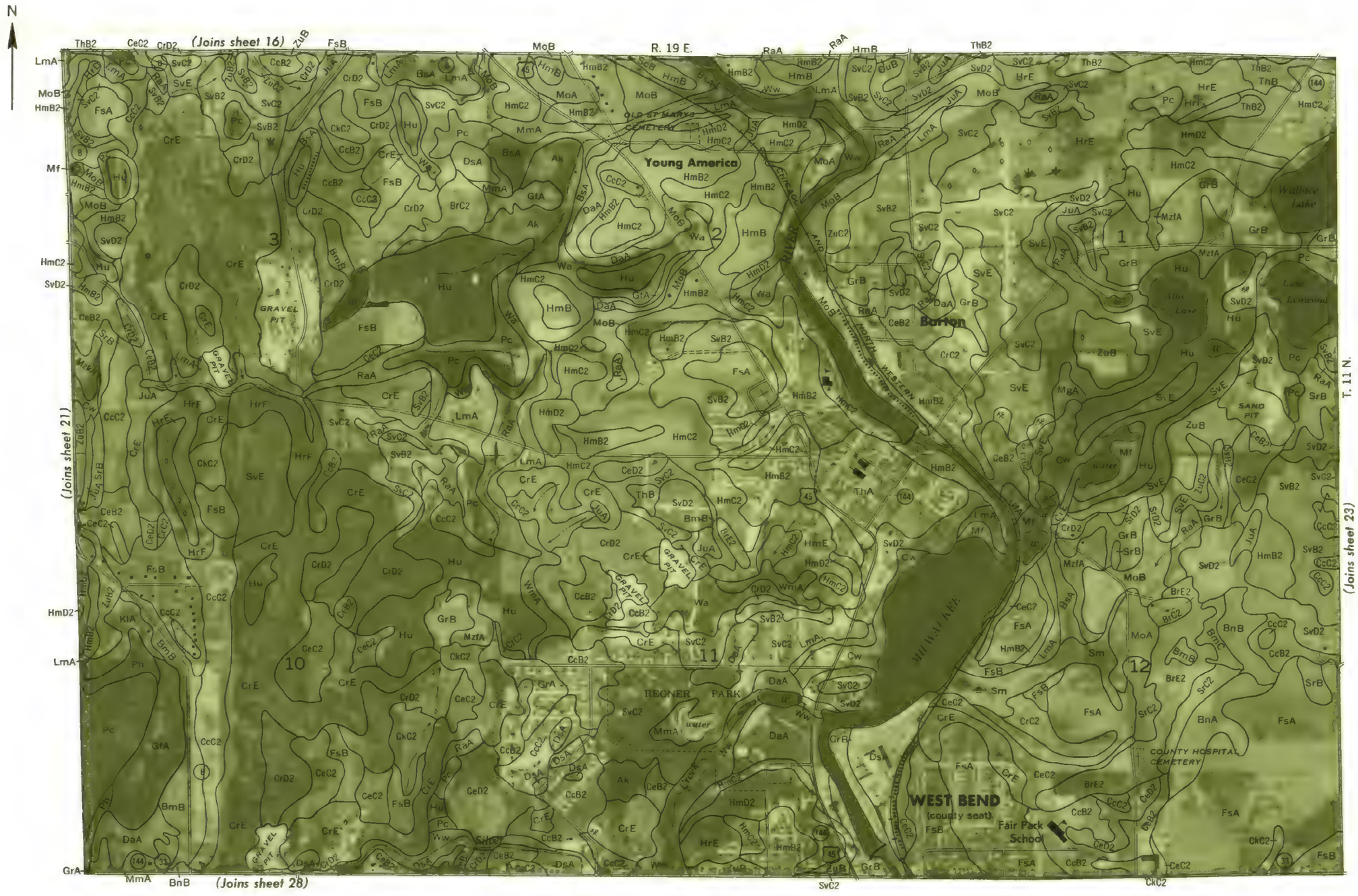
WASHINGTON COUNTY, WISCONSIN NO. 20

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station.



...p is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and ...ver, Soils Department, and Wisconsin Agricultural Experiment Station.
...versity of Wisconsin, Wisconsin Geological and Natural History Survey, Soils D...
Land division corners are approximately p...
WASHINGTON COUNTY, WISCO... 21



Scale 1:15840

1 Mile 0 ½ ¼ ⅛ 1

5000 Feet 0 1000 2000 3000 4000 5000

WASHINGTON COUNTY, WISCONSIN NO. 22

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station.

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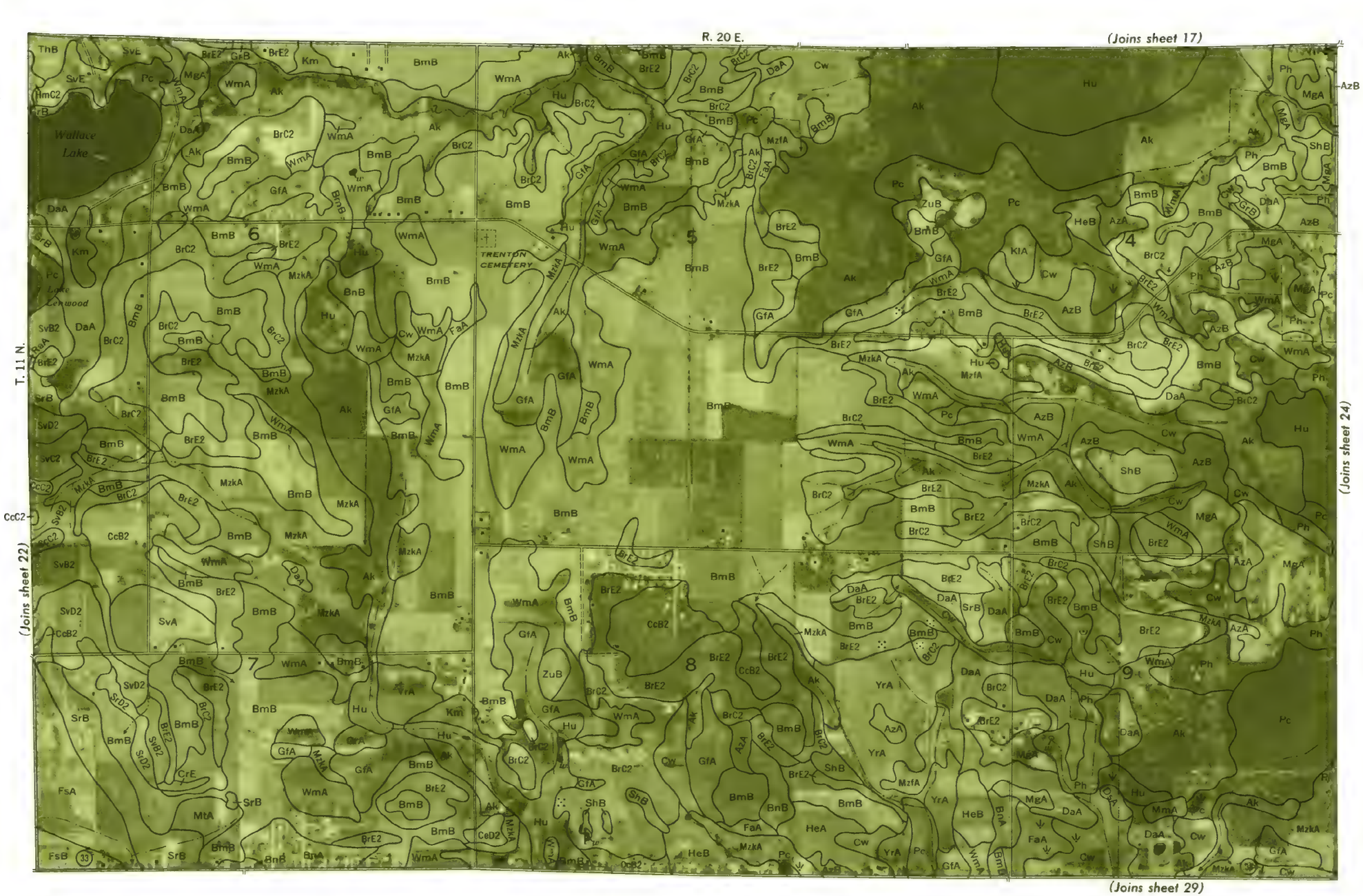
WASHINGTON COUNTY, WISCONSIN NO. 23



Scale 1:15840

1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:15840

1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

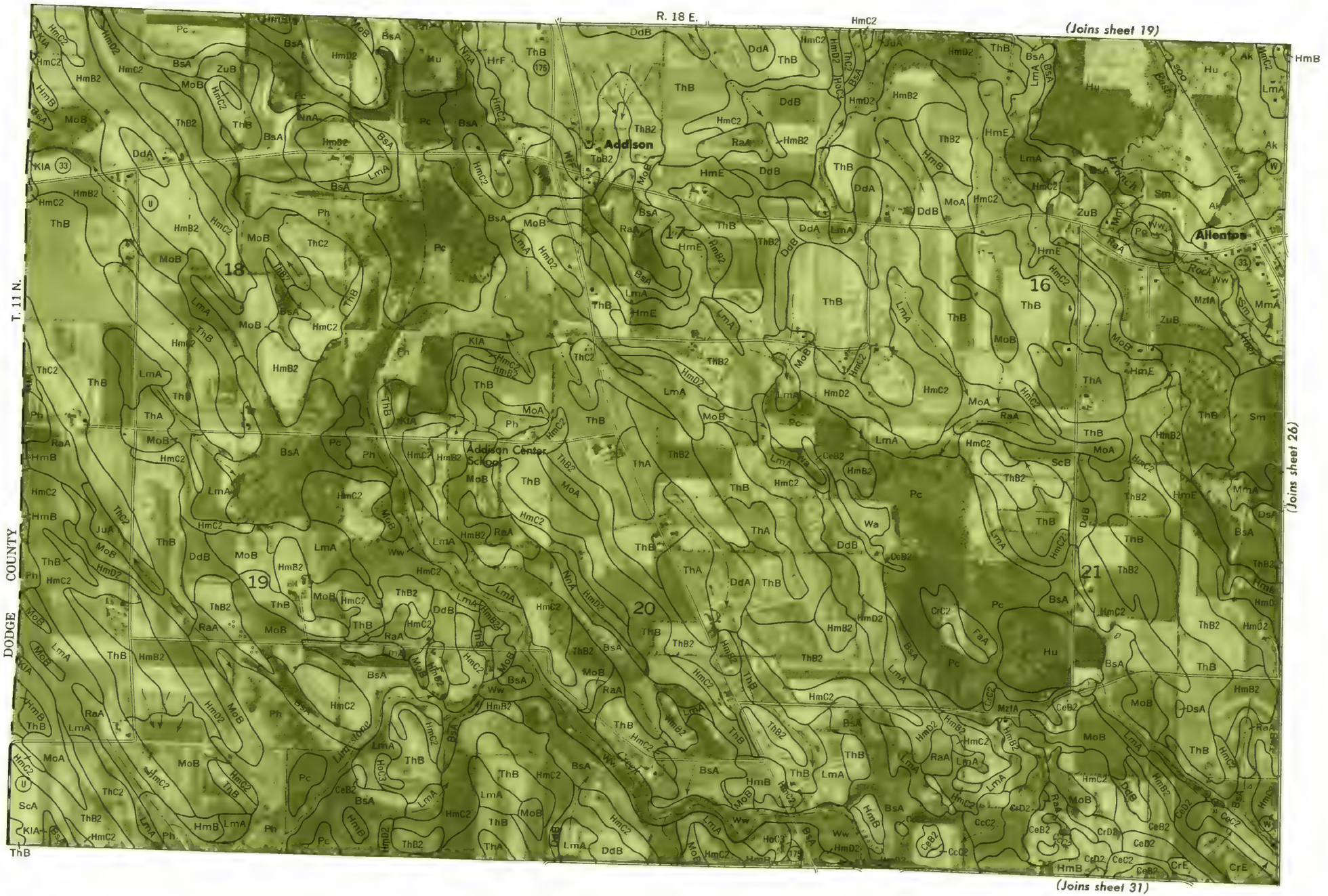
WASHINGTON COUNTY, WISCONSIN NO. 24

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, and Wisconsin Agricultural Experiment Station.

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station.
Land division corners are approximately positioned on this map.

WASHINGTON COUNTY, WISCONSIN NO. 25



Scale 1:15840

1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

WASHINGTON COUNTY, WISCONSIN NO. 26

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station.

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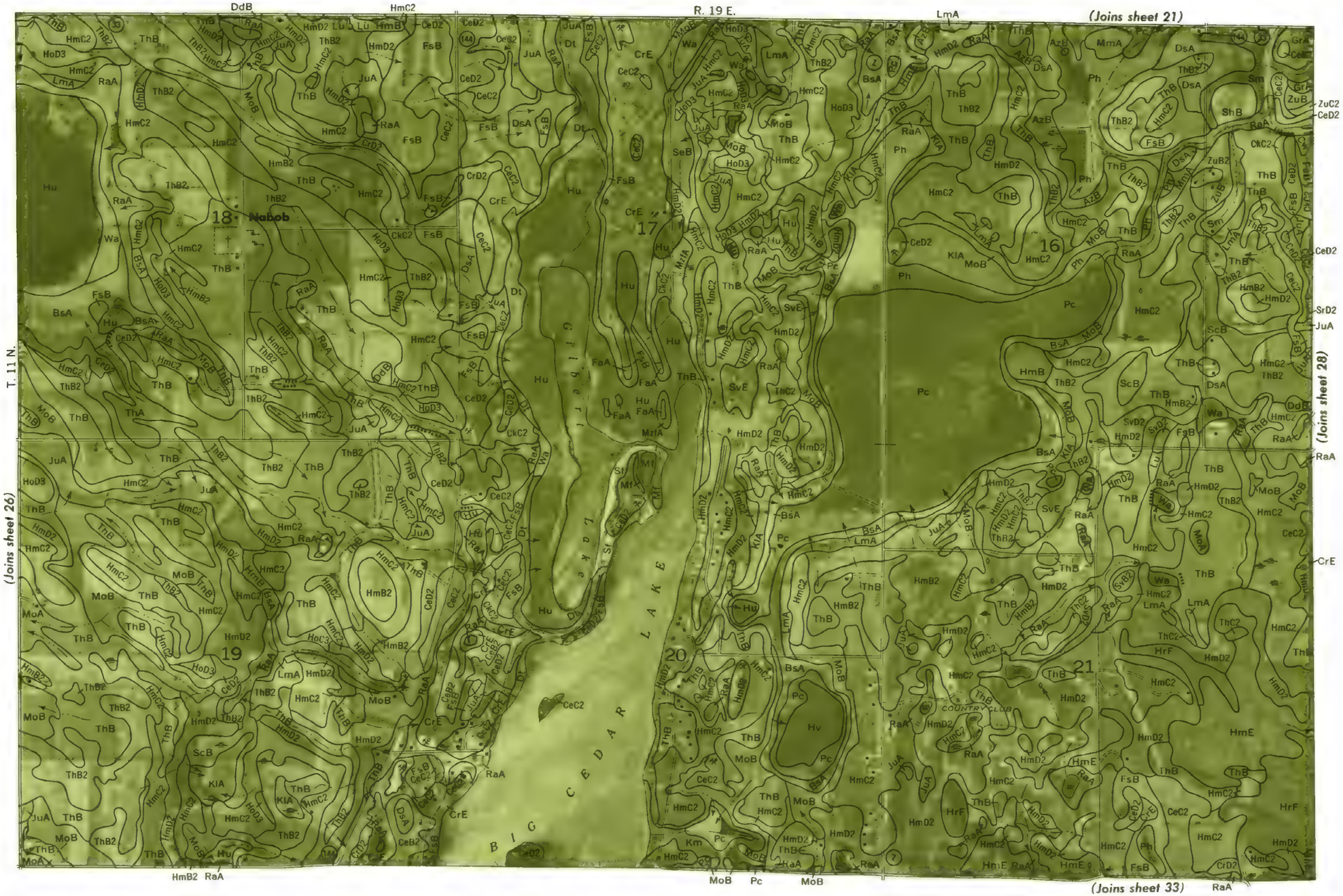
WASHINGTON COUNTY, WISCONSIN NO. 27



Scale 1:15840

1 Mile — ¾ — ½ — ¼ — 0

5000 — 4000 — 3000 — 2000 — 1000 — 0 — 5000 Feet

Scale 1:15840

1 Mile — 5000 Feet

WASHINGTON COUNTY, WISCONSIN NO. 28

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station.

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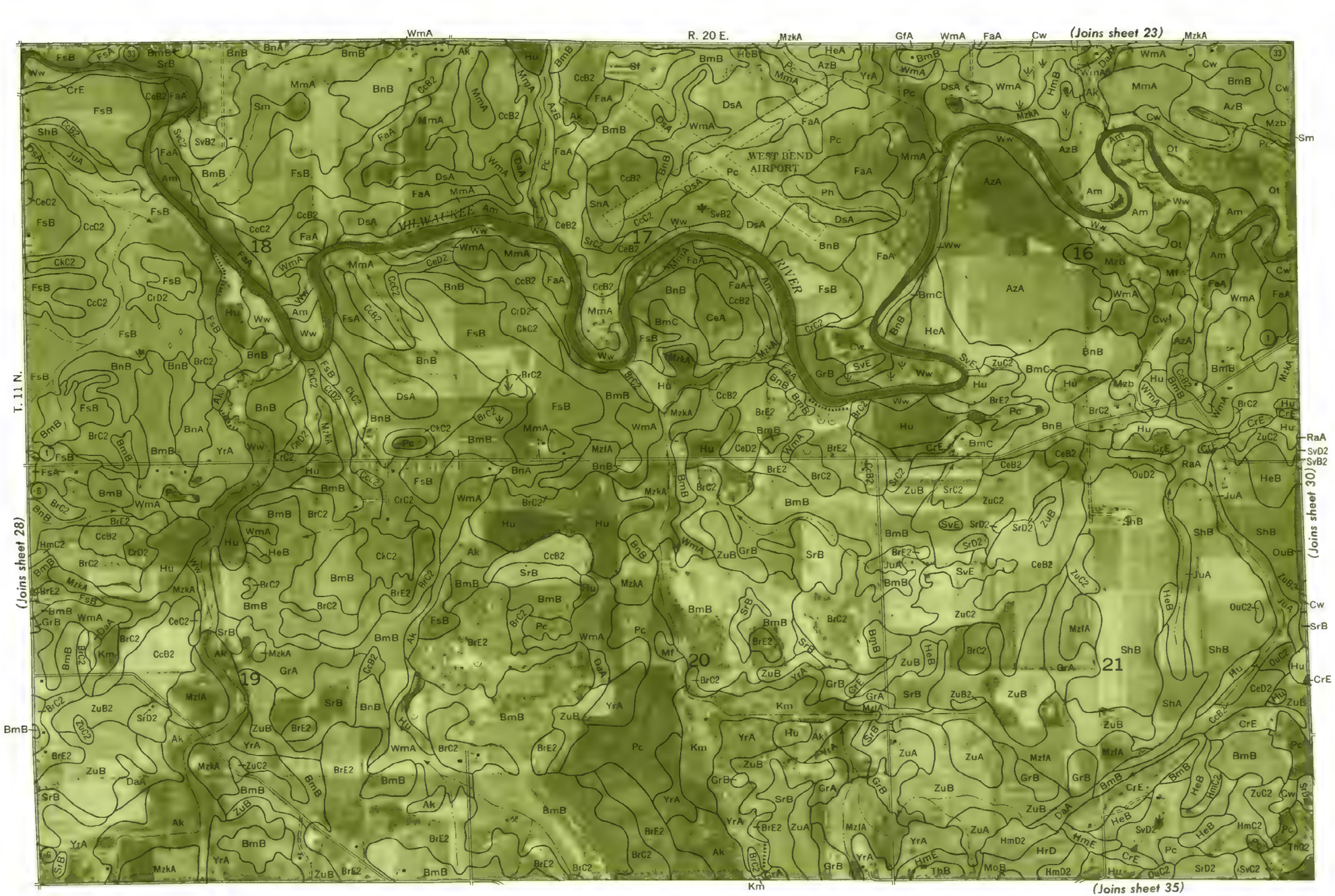
WASHINGTON COUNTY, WISCONSIN NO. 29



Scale 1:15840

1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:15840

1 Mile 0 ½ ¼ ⅜ 1

5000 Feet 0 1000 2000 3000 4000 5000

WASHINGTON COUNTY, WISCONSIN NO. 30

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station.

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Land division corners are approximately positioned on this map.

WASHINGTON COUNTY, WISCONSIN NO. 31

Scale 1:15840

1 Mile 0 ¼ ½ ¾ 1

5000 Feet 0 1000 2000 3000 4000 5000

N

(Joins sheet 26)

R. 18 E.

T. 11 N.

(Joins sheet 31)

(Joins sheet 33)

(Joins sheet 38)

(Joins sheet 39)

Scale 1:15840

1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

WASHINGTON COUNTY, WISCONSIN NO. 32

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station.

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WASHINGTON COUNTY, WISCONSIN NO. 33

N

R. 19 E.

T. 11 N.

(Joins sheet 28)

(Joins sheet 33)

(Joins sheet 35)

(Joins sheet 40)

(Joins sheet 41)

Fourth District School

Silver Maple School

Bethel Church

GRAVEL PIT

Little Lake

Silver Lake

NORTH WESTERN AND CHICAGO

Scale 1:15840

1 Mile 0 1/4 1/2 3/4 1

5000 4000 3000 2000 1000 0 5000 Feet

WASHINGTON COUNTY, WISCONSIN NO. 34

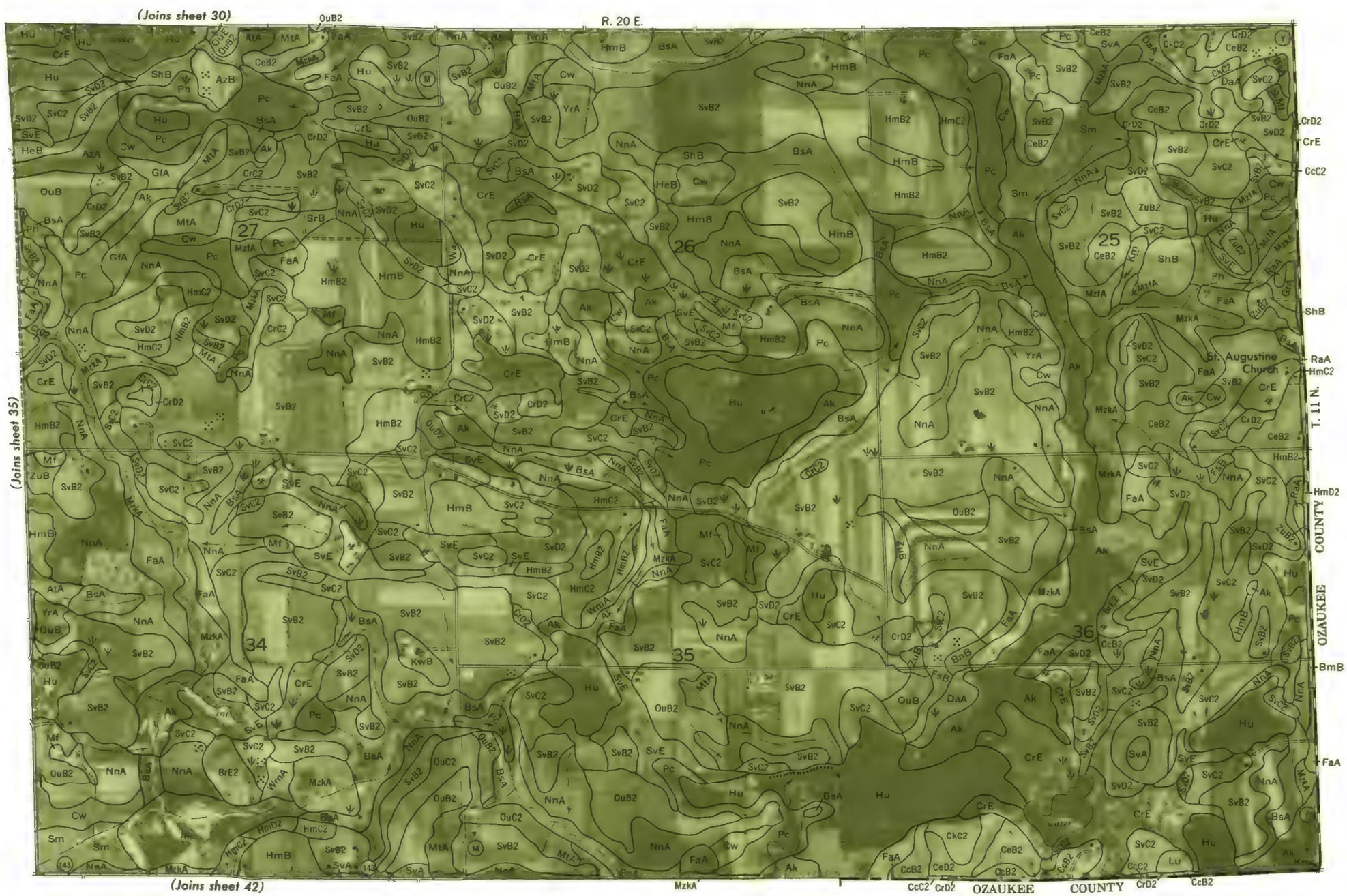
Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, in cooperation with the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station.

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station. Land division corners are approximately positioned on this map.

WASHINGTON COUNTY, WISCONSIN NO. 35

N



Scale 1:15840

1 Mile 0 1/4 1/2 3/4 1

5000 4000 3000 2000 1000 0 5000 Feet

WASHINGTON COUNTY, WISCONSIN NO. 36

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station.

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station. Land division corners are approximately positioned on this map.

WASHINGTON COUNTY, WISCONSIN NO. 37

DODGE COUNTY

R. 18 E.

T. 10 N.

DODGE COUNTY

HARTFORD AIRPORT

(Joins sheet 31)

(Joins sheet 38)

(Joins sheet 43)

N

Scale 1:15840

1 ¾ ½ ¼ 0 1 Mile

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

Scale 1:15840

1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

WASHINGTON COUNTY, WISCONSIN N.C. 38

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station.

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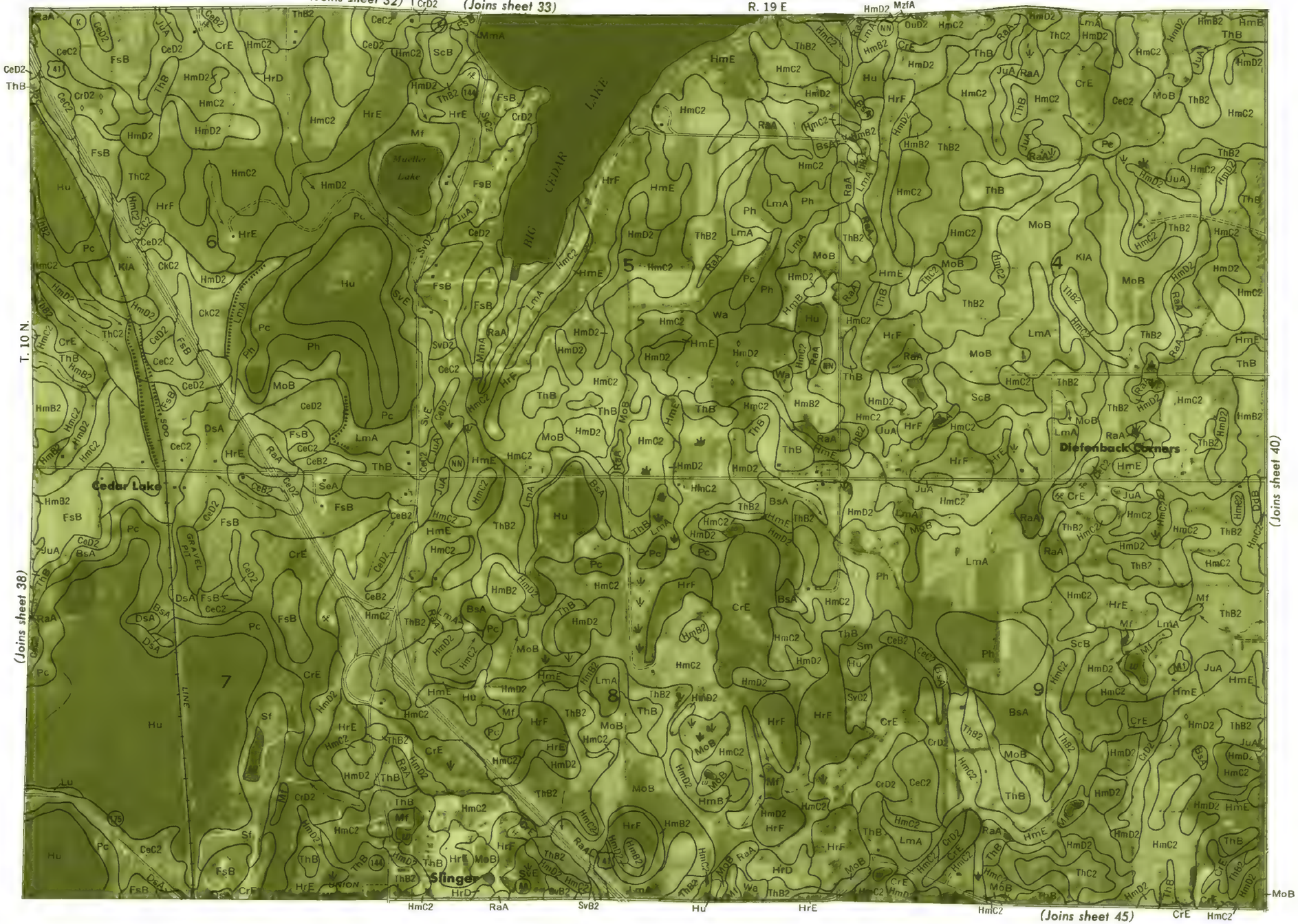
WASHINGTON COUNTY, WISCONSIN NO. 39



Scale 1:15840

1 Mile 0 ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

N

(Joins sheet 33) | (Joins sheet 34)

R. 19 E.

(Joins sheet 39)

(Joins sheet 41)

(Joins sheet 46)

T. 10 N.

Cedar Creek

MAXON CEMETERY

Scale 1:15840

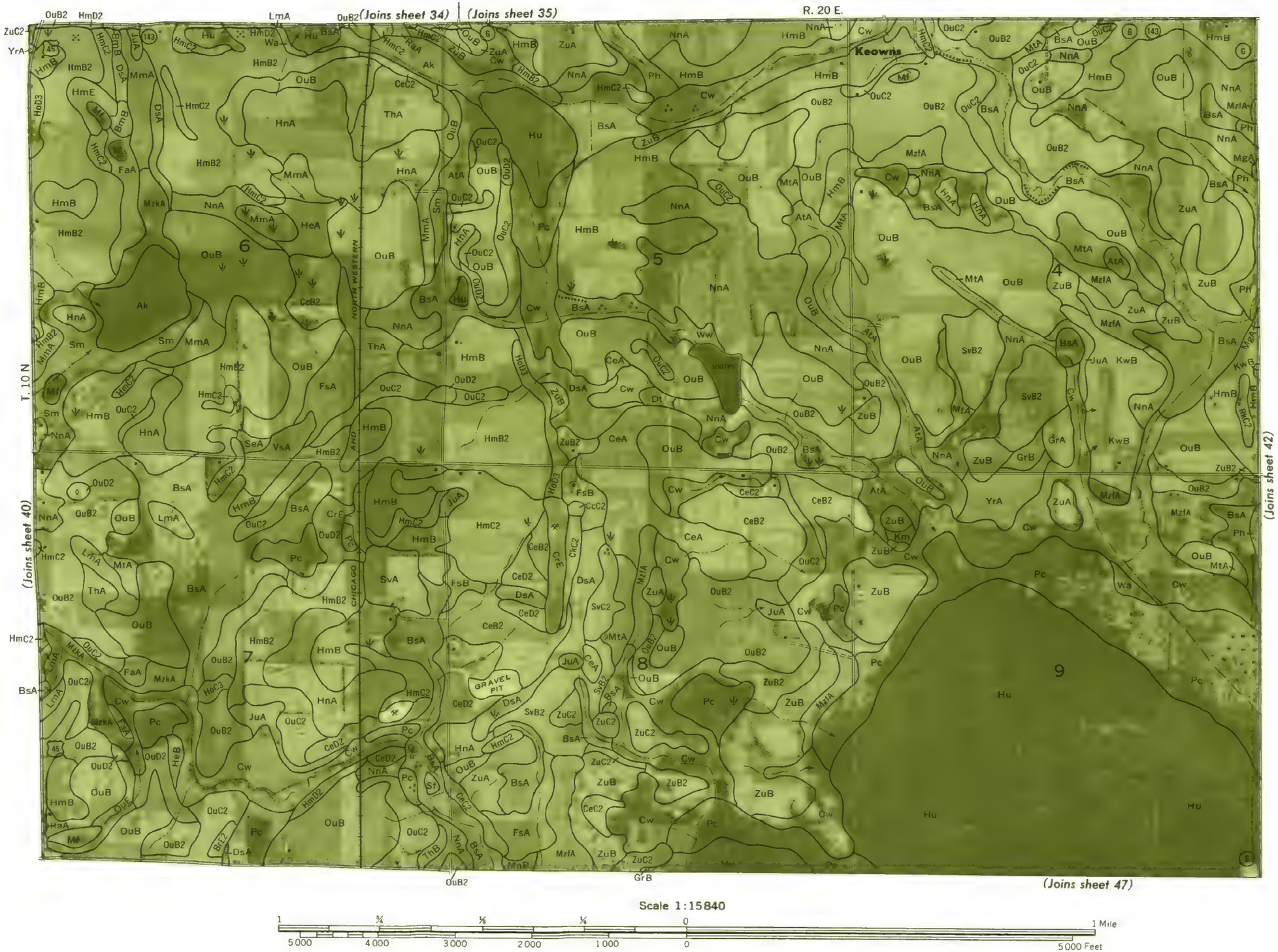
1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

WASHINGTON COUNTY, WISCONSIN NO. 40

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture. Land division corners are approximately positioned on this map.

the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station.



This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station.
Land division corners are approximately positioned on this map.

WASHINGTON COUNTY, WISCONSIN NO. 41

N

(Joins sheet 35) | (Joins sheet 36)

R. 20 E.

T. 10 N.

(Joins sheet 41)

(Joins sheet 48)

Trinity School

ST MARYS CEMETERY

CEDAR CREEK

OZAUKEE COUNTY

Scale 1:15840

1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

WASHINGTON COUNTY, WISCONSIN NO. 42

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station.

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WASHINGTON COUNTY, WISCONSIN NO. 43

R. 18 E.

T. 10 N.

DODGE COUNTY

(Joins sheet 37)

(Joins sheet 44)

(Joins sheet 49)

N

Scale 1:15840

1 Mile 0 ¼ ½ ¾ 1

5000 Feet 0 1000 2000 3000 4000 5000

Scale 1:15840

1 Mile 0 ½ ¼ ¾ 1

5000 Feet 0 1000 2000 3000 4000 5000

WASHINGTON COUNTY, WISCONSIN NO. 44

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station.

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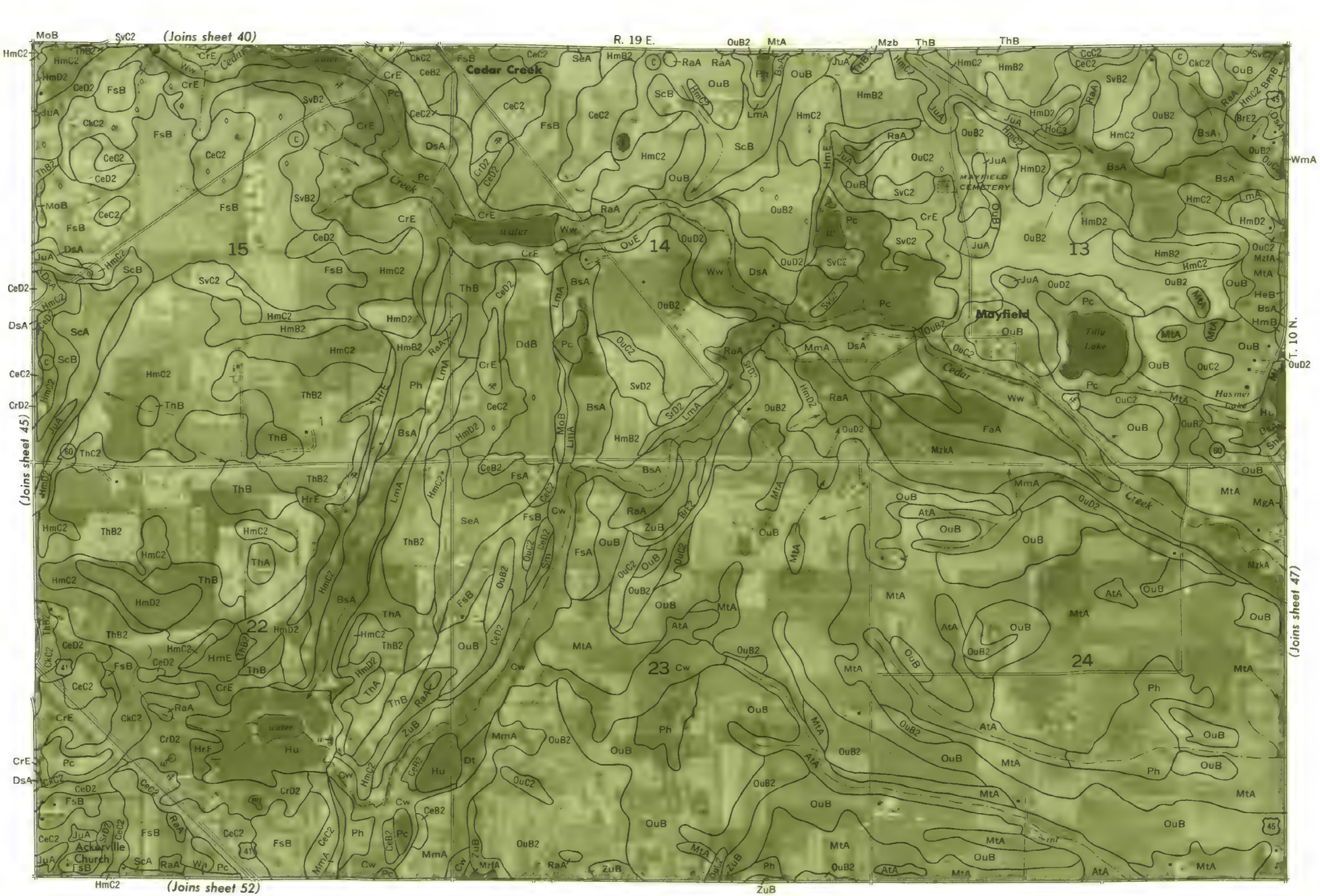
Land division corners are approximately positioned on this map.

WASHINGTON COUNTY, WISCONSIN NO. 45

Scale 1:15840

1 Mile — 5000 Feet



Scale 1:15840

1 Mile — 5 000 Feet

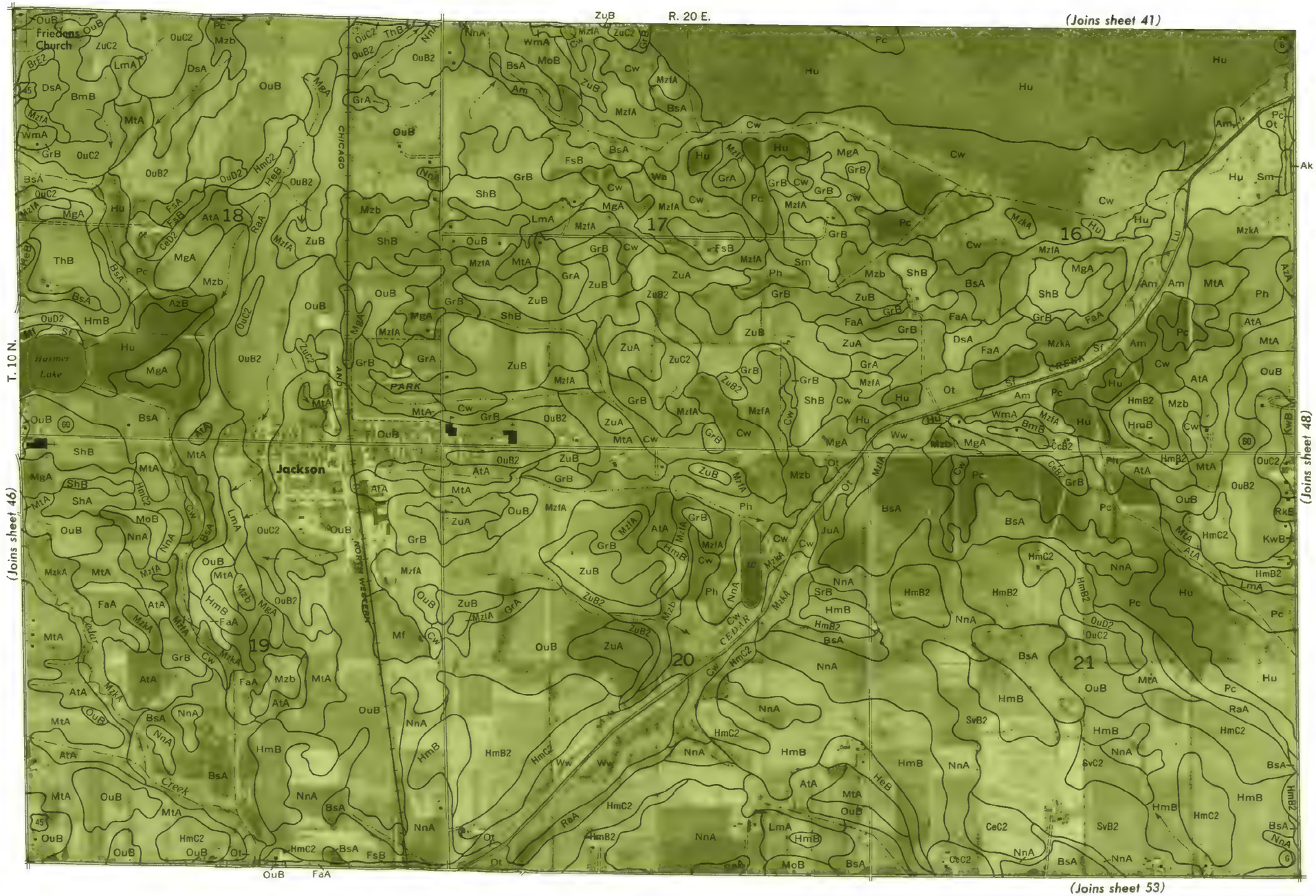
WASHINGTON COUNTY, WISCONSIN NO. 46

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station.

This map is one of a set compiled in 1959 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station. Land division corners are approximately positioned on this map.

WASHINGTON COUNTY, WISCONSIN NO. 47



N

Scale 1:15840

1 Mile ⅞ ½ ⅛ 0

5000 4000 3000 2000 1000 0 5000 Feet

WASHINGTON COUNTY, WISCONSIN NO. 48

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station.

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Land division corners are approximately positioned on this map.

WASHINGTON COUNTY, WISCONSIN NO. 49

N

R. 18 E.

T. 10 N.

DODGE COUNTY

(Joins sheet 43)

(Joins sheet 50)

(Joins sheet 55)

HARTFORD

Hartford High School

Lincoln School

GRAVEL PIT

DUMP

Scale 1:15840

1 Mile

5 000 Feet

WASHINGTON COUNTY, WISCONSIN NO. 50

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station.

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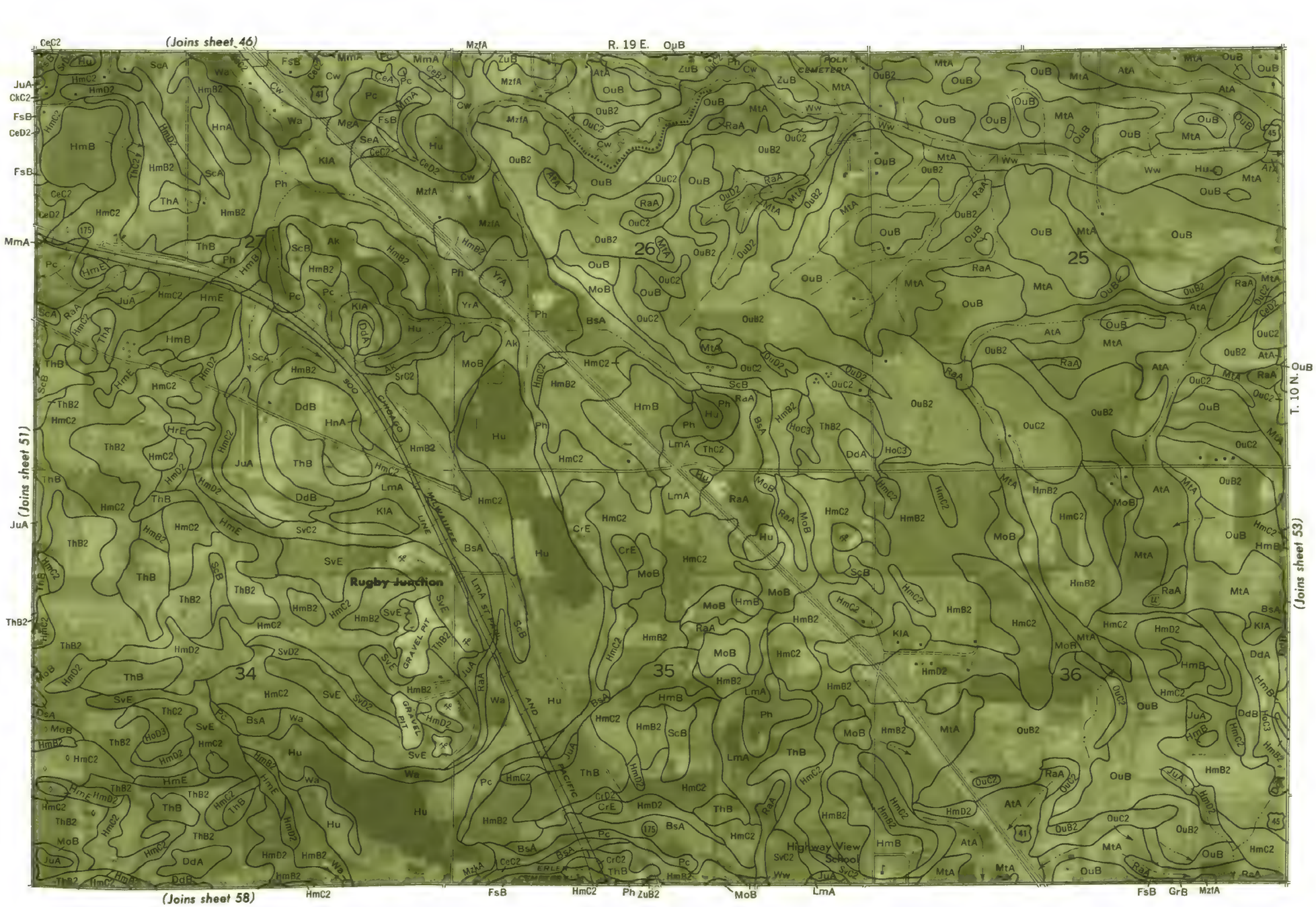
WASHINGTON COUNTY, WISCONSIN NO. 51



Scale 1:15840

1 ¾ ½ ¼ 0 1 Mile

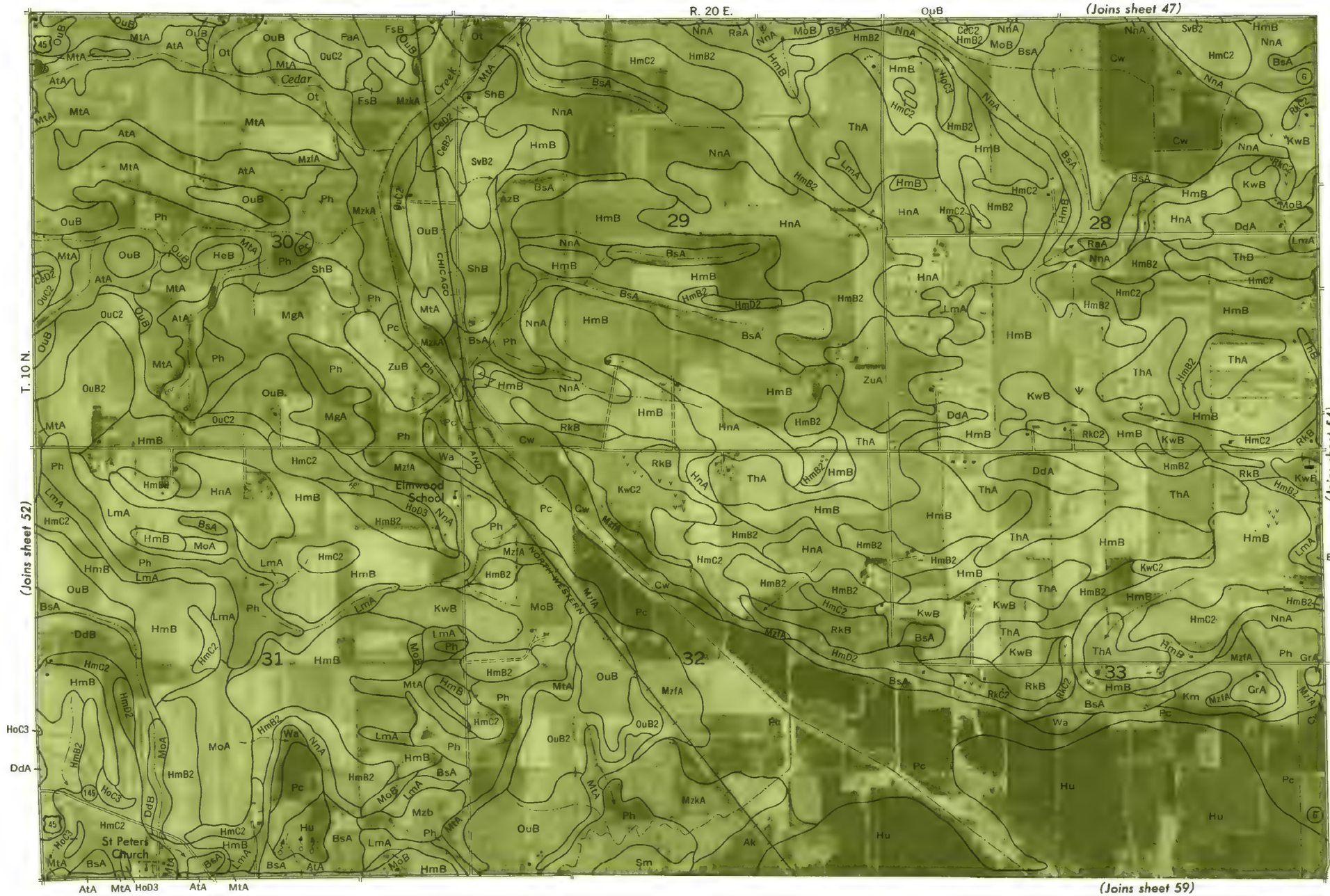
5000 4000 3000 2000 1000 0 5000 Feet

WASHINGTON COUNTY, WISCONSIN NO. 52

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agricultur
Land division corners are approximately positioned on this map.
by the Soil Survey, Soils Department, and Wisconsin Agricultural Experiment Stati
the University of Wisconsin, Wisconsin Geological and Natural History Survey

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, and Wisconsin Agricultural Experiment Station. Land division corners are approximately positioned on this map.

WASHINGTON COUNTY, WISCONSIN NO. 53



N

Scale 1:15840

1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

WASHINGTON COUNTY, WISCONSIN NO. 54

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station.

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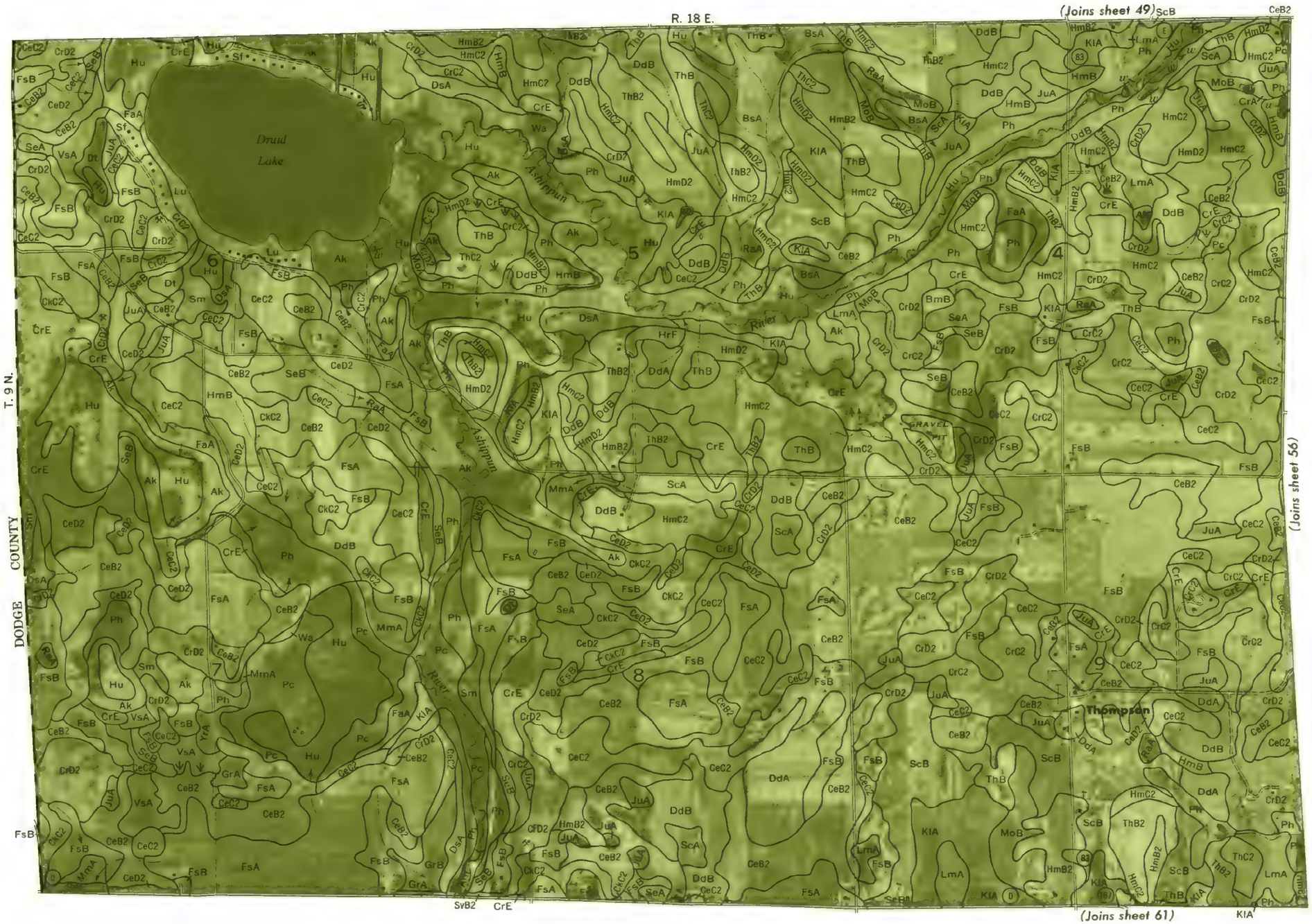
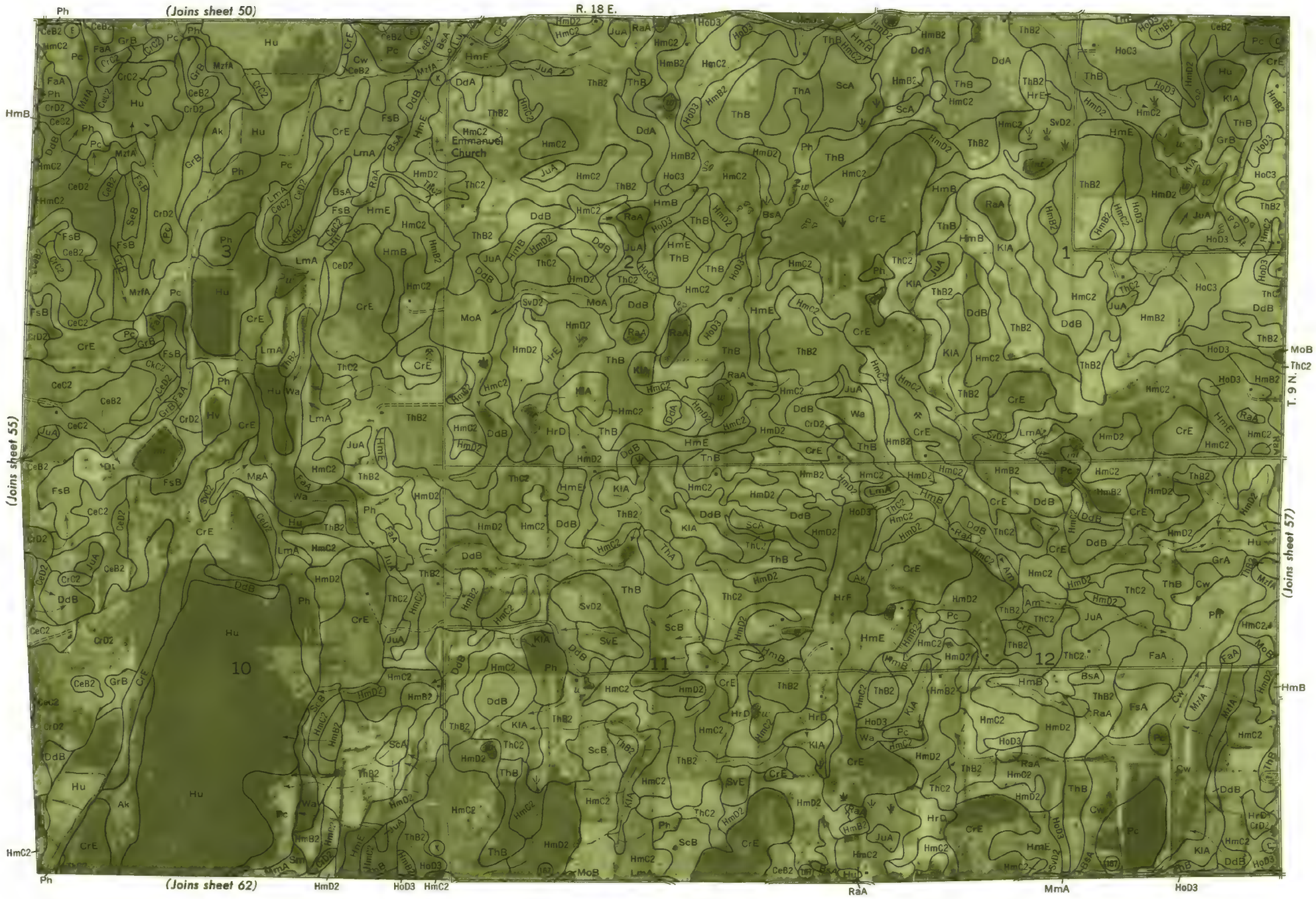
Land division corners are approximately positioned on this map.

WASHINGTON COUNTY, WISCONSIN NO. 55





WASHINGTON COUNTY, WISCONSIN NO. 56

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Statio

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Land division corners are approximately positioned on this map.

WASHINGTON COUNTY, WISCONSIN NO. 57

WASHINGTON COUNTY, WISCONSIN NO. 58

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station.

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WASHINGTON COUNTY, WISCONSIN NO. 59

R. 20 E.

T. 9 N.

(Joins sheet 53)

(Joins sheet 58)

(Joins sheet 60)

(Joins sheet 65)

N

Rockfield

Rockfield School

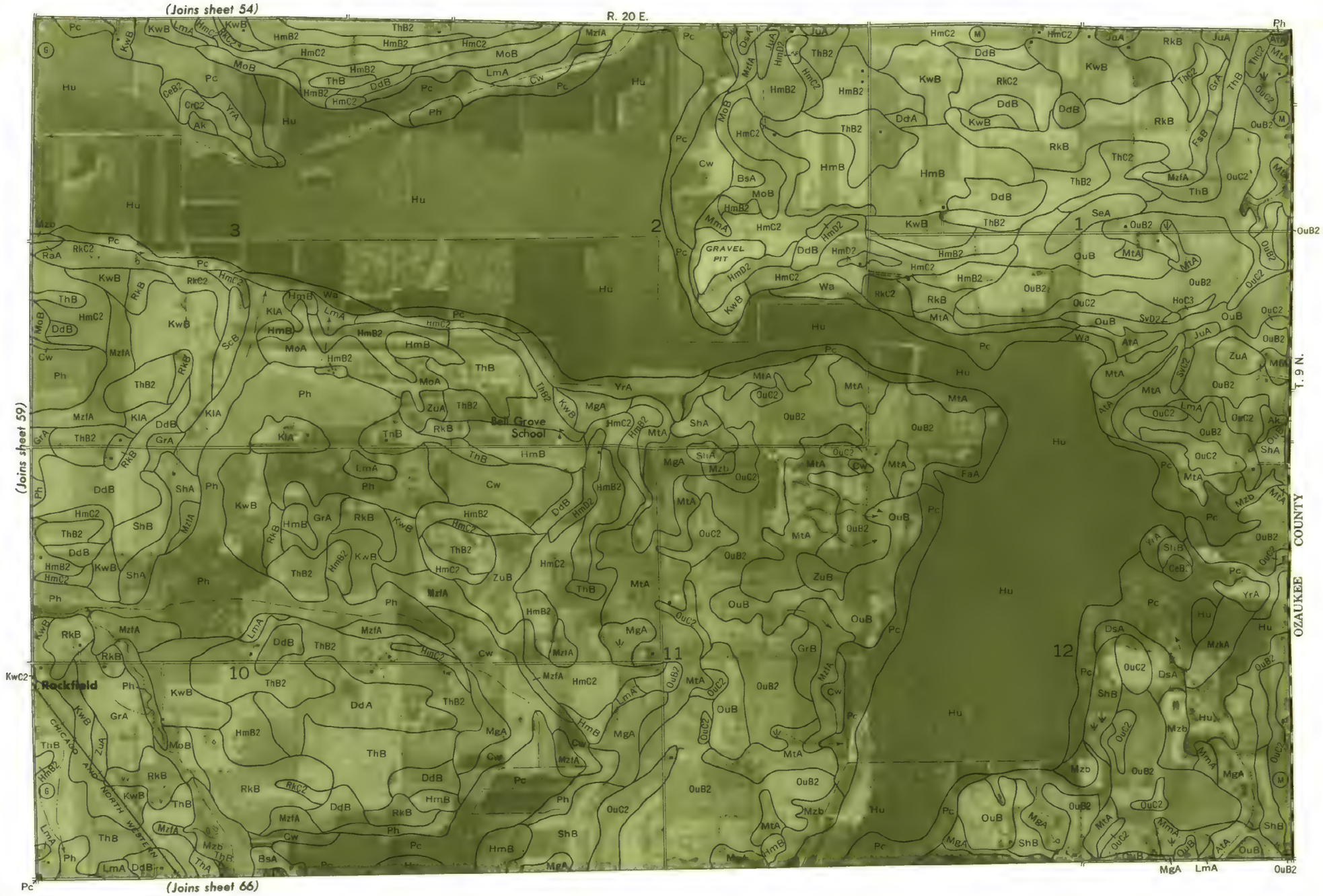
Dheinsville

NORTHWESTERN

Scale 1:15840

1 Mile

5 000 Feet



Scale 1:15840

1 Mile ¾ ½ ¼ 0

5000 4000 3000 2000 1000 0 5 000 Feet

WASHINGTON COUNTY, WISCONSIN NO. 60

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1959 as part of a soil survey by the Soil Conservation Service, United States Department of Agricultura, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Statio

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Land division corners are approximately positioned on this map.

WASHINGTON COUNTY, WISCONSIN NO. 61

N

T. 9 N.

R. 18 E.

COUNTY

DODGE

(Joins sheet 55)

(Joins sheet 62)

(Joins sheet 67)

Erin School

Ashippun River

Murphy Lake

Malloy Lake

Scale 1:15840

1 Mile

5000 Feet

N

(Joins sheet 56)

R. 18 E.

T. 9 N.

(Joins sheet 61)

(Joins sheet 63)

(Joins sheet 68)

Holy Hill

McConville Lake

Scale 1:15840

1 Mile

5000 Feet

WASHINGTON COUNTY, WISCONSIN NO. 62

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station.

Land division corners are approximately positioned on this map.

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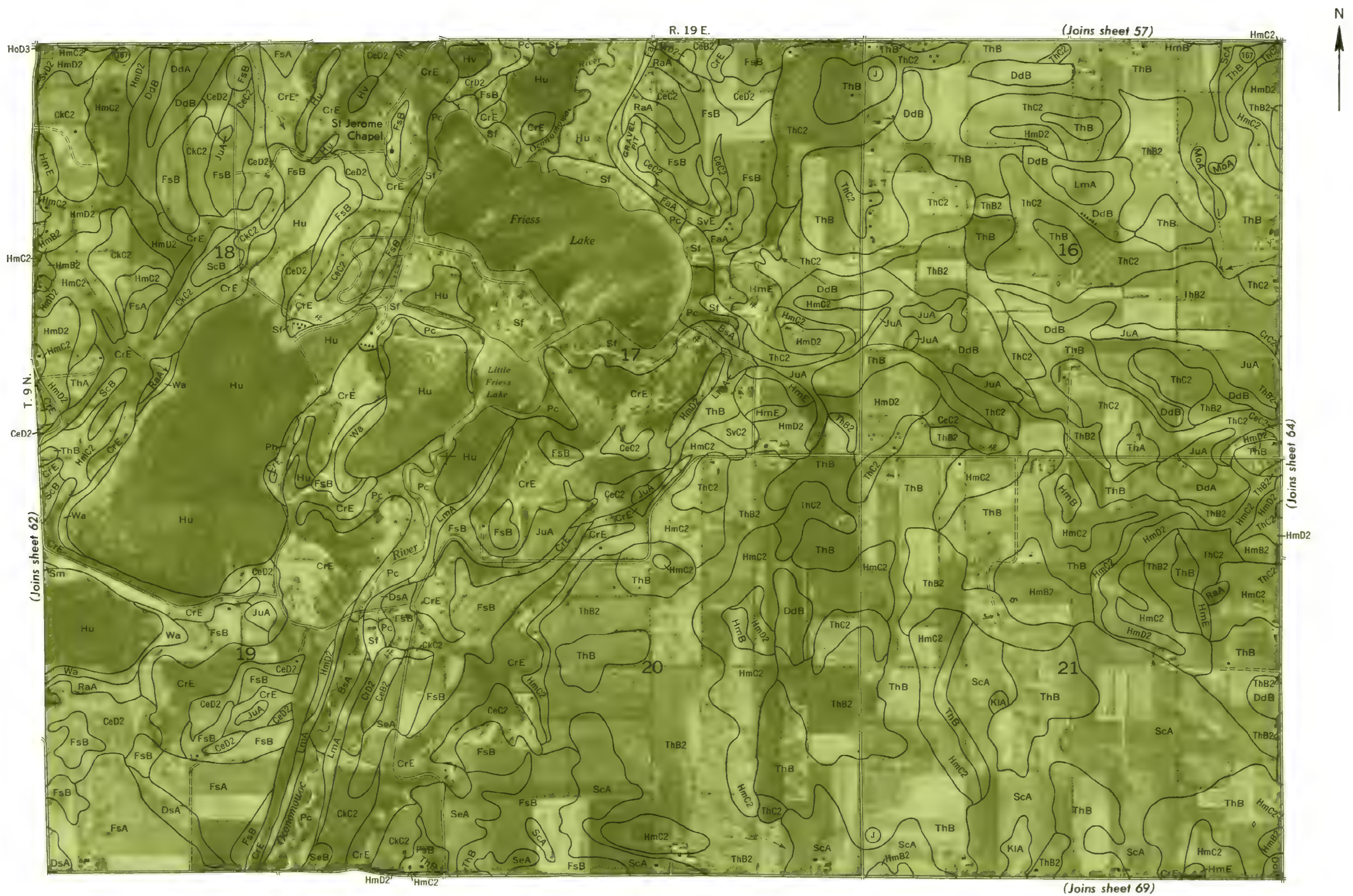
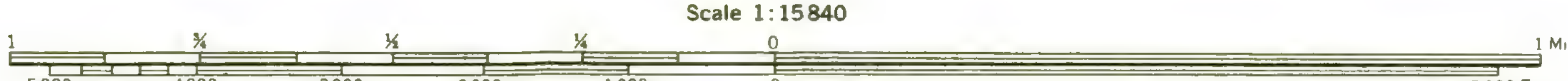
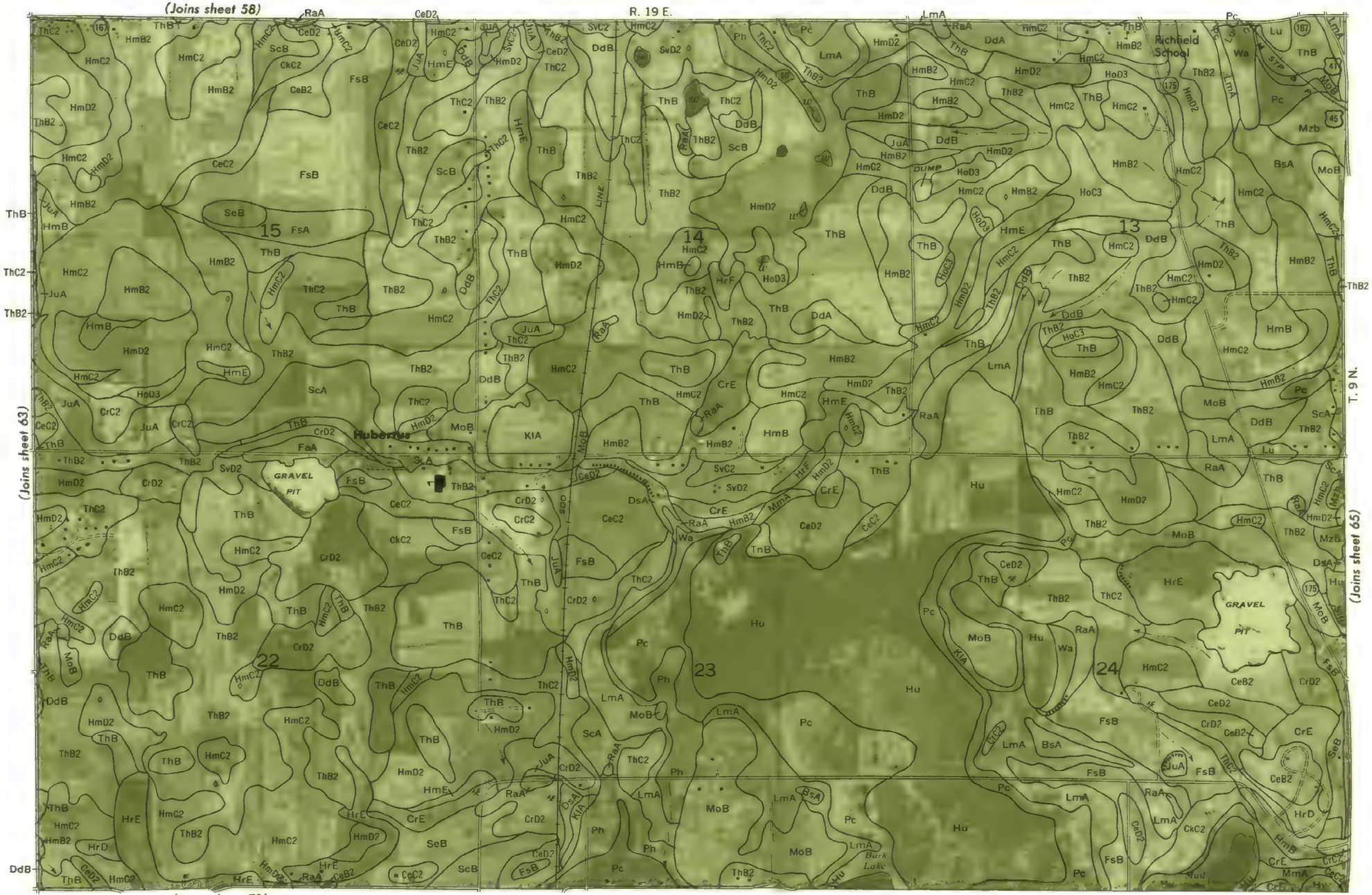
Land division corners are approximately positioned on this map.

WASHINGTON COUNTY, WISCONSIN NO. 63



Scale 1:15840





WASHINGTON COUNTY, WISCONSIN NO. 64

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station.

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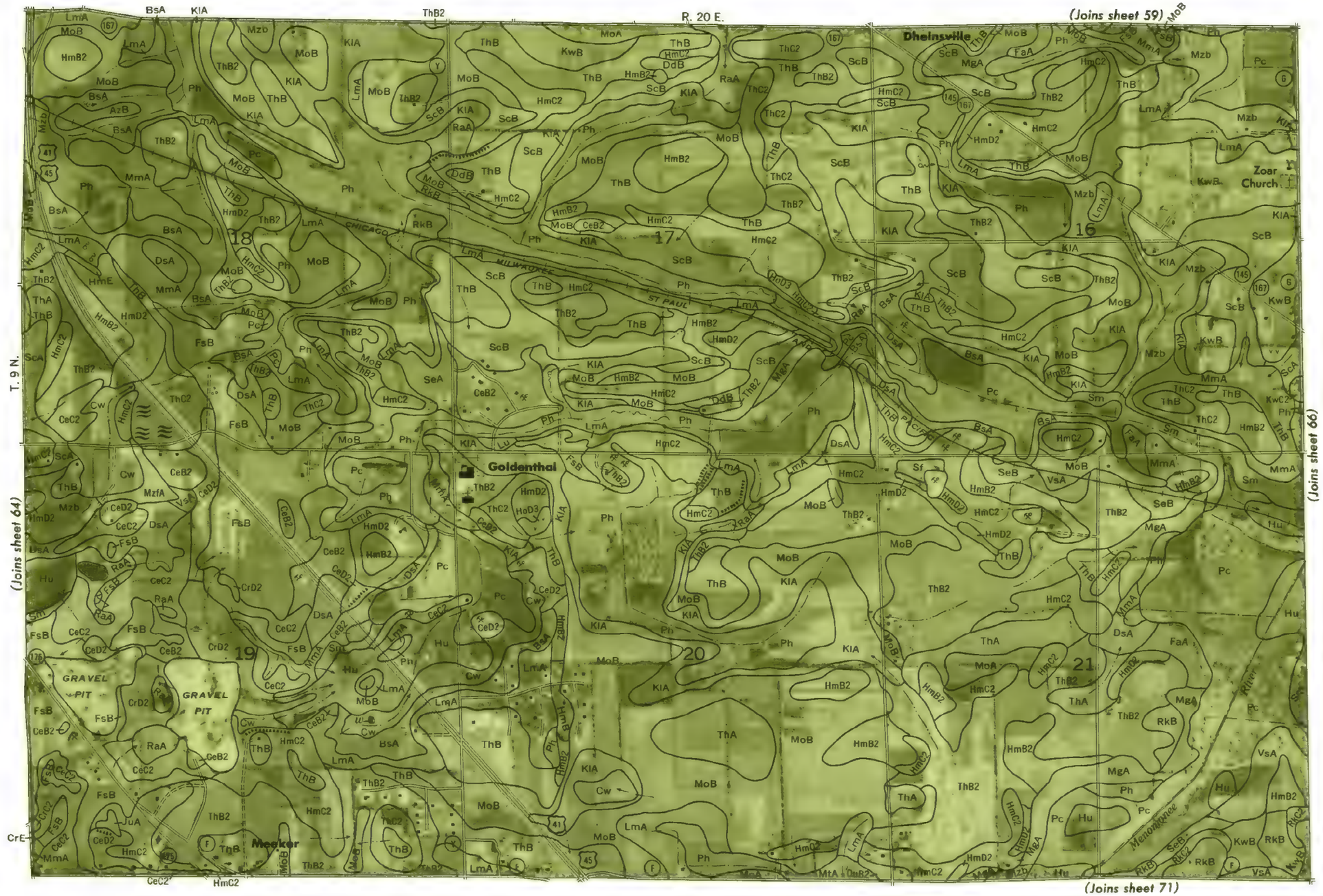
Land division corners are approximately positioned on this map.

WASHINGTON COUNTY, WISCONSIN NO. 65



Scale 1:15840

1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

N

(Joins sheet 60)

R. 20 E.

T. 9 N.

(Joins sheet 65)

(Joins sheet 72)

GERMANTOWN

Menomonee River

CHICAGO

MILWAUKEE

NORTH WESTERN

PARK

OZAUKEE COUNTY

Scale 1:15840

1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

WASHINGTON COUNTY, WISCONSIN NO. 66

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station.

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WASHINGTON COUNTY, WISCONSIN NO. 67

R. 18 E.

T. 9 N.

N

ThB (Joins sheet 61)

(Joins sheet 68)

DODGE COUNTY

WAUKESHA COUNTY

Scale 1:15840

1 Mile

5000 Feet

Scale 1:15840

1 Mile — 5000 Feet

WASHINGTON COUNTY, WISCONSIN NO. 68

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station.

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Land division corners are approximately positioned on this map.

WASHINGTON COUNTY, WISCONSIN NO. 69

N

R. 19 E.

T. 9 N.

(Joins sheet 63)

(Joins sheet 68)

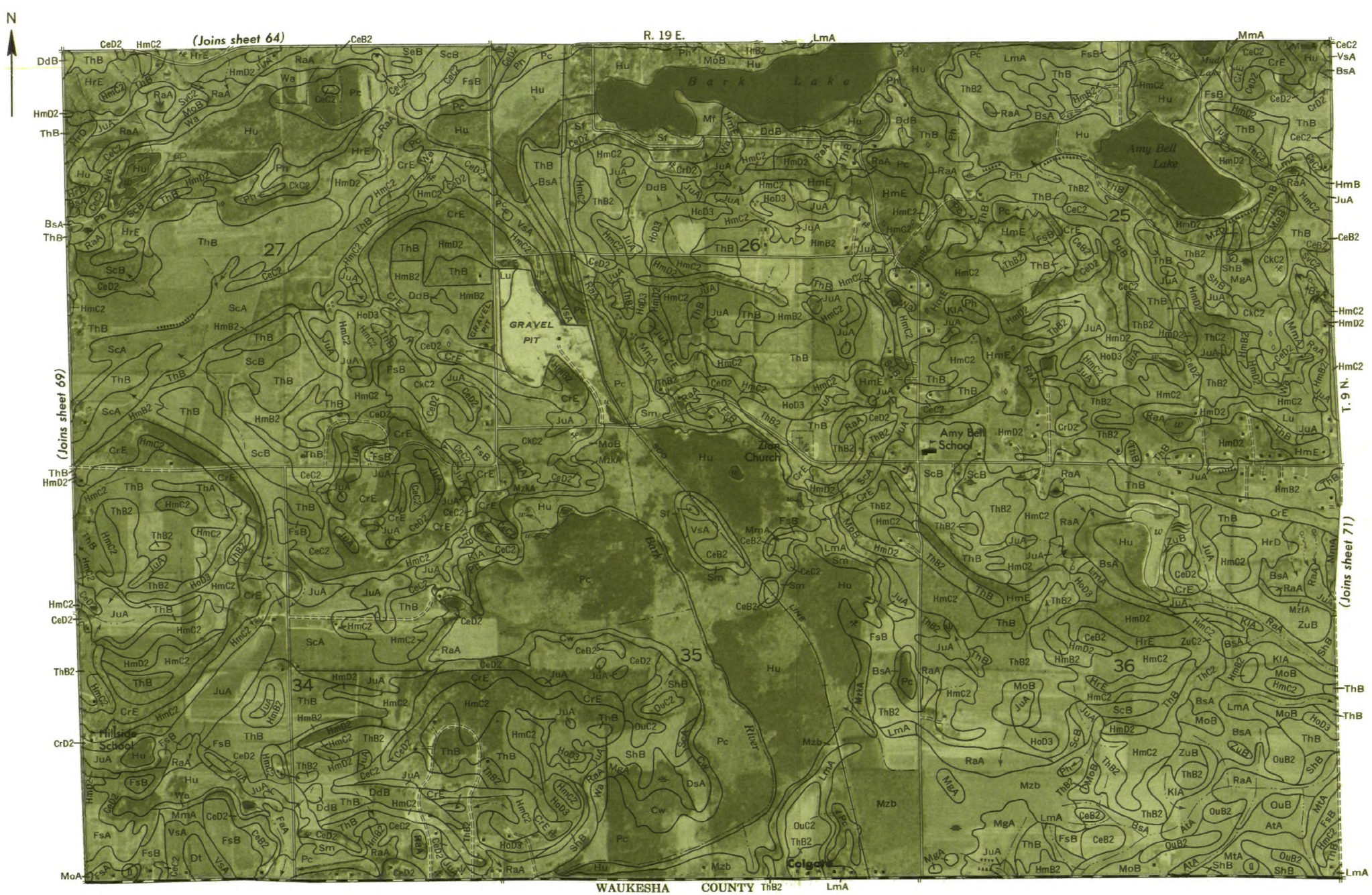
(Joins sheet 70)

WAUKESHA COUNTY

Scale 1:15840

1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet



Scale 1:15840

1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

WASHINGTON COUNTY, WISCONSIN NO. 70

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Statio

Scale 1:15840

1 Mile 0 ¼ ½ ¾ 1

5000 4000 3000 2000 1000 0 5000 Feet

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Land division corners are approximately positioned on this map.

WASHINGTON COUNTY, WISCONSIN NO. 71

N

(Joins sheet 66)

R. 20 E.

(Joins sheet 71)

T. 9 N.

OZAUKEE COUNTY

WAUKESHA COUNTY

Victory Center

County Line School

CHICAGO MILWAUKEE

NORTH WESTERN

GRAVEL PIT

DUMP

Scale 1:15840

1 Mile 0 1/8 1/4 1/2 3/4 1

5000 Feet 0 1000 2000 3000 4000 5000

WASHINGTON COUNTY, WISCONSIN NO. 72

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1969 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soils Department, and Wisconsin Agricultural Experiment Station